

Maharashtra State Board Of Technical Education, Mumbai																								
Learning and Assessment Scheme for Post S.S.C Diploma Courses																								
Programme Name		: Diploma In Mining & Mine Surveying																						
Programme Code		: MS										With Effect From Academic Year				: 2023-24								
Duration Of Programme		: 3 Year										Duration				: 32 WEEKS								
Year		: Third		NCrF Entry Level : 4.0						Scheme				: K										
Sr No	Course Title	Abbreviation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory			Based on LL & TL				Based on Self Learning	Total Marks			
						CL	TL	LL								Practical								
													FA-TH	SA-TH	Total	FA-PR		SA-PR				SLA		
																Max	Min	Max	Min				Max	Min
(All Compulsory)																								
1	MINE LEGISLATION AND MANAGEMENT	MLS	DSC	333301	-	3	1	-	-	4	4	1.5	30	70*#	100	40	25	10	25#	10	-	-	150	
2	SURFACE MINING	SME	DSC	333302	-	3	-	-	-	3	3	3	30	70	100	40	-	-	-	-	-	-	100	
3	ADVANCED MINE SURVEYING	AMS	DSC	333303	-	3	-	2	-	5	5	3	30	70	100	40	25	10	25#	10	-	-	150	
4	MINE ENVIRONMENT	MEV	DSC	333304	-	3	-	2	-	5	5	3	30	70	100	40	25	10	25#	10	-	-	150	
5	MINE MACHINARY	MMC	DSC	333305	1	3	-	2	-	5	5	1.5	30	70*#	100	40	25	10	25#	10	-	-	150	
6	WINNING AND WORKING - NON COAL	WNC	DSC	333306	-	3	-	2	-	5	5	3	30	70	100	40	25	10	25#	10	-	-	150	
7	ENTREPRENEURSHIP AND STARTUPS IN MINING	EDM	AEC	333001	-	-	-	1	1	2	2	-	-	-	-	50	20	25@	10	25	10	100		
8	INDUSTRIAL TRAINING / PROJECT 2	ITR	INP	333002	-	-	-	2	4	6	6	-	-	-	-	50	20	50#	20	100	40	200		
ELECTIVE -1 (Any - One)																								
9	ELEMENTS OF MECHATRONICS	EMS	DSE	333307	-	2	-	-	1	3	3	3	30	70	100	40	-	-	-	-	50	20	150	
	HEALTH AND SAFETY IN MINING	HSM	DSE	333308	-	2	-	-	1	3	3	3	30	70	100	40	-	-	-	-	50	20	150	
	MINE AND MINERAL ECONOMICS	MEC	DSE	333309	1	2	-	-	1	3	3	3	30	70	100	40	-	-	-	-	50	20	150	
ELECTIVE -2 (Any - One)																								
10	POLLUTION CONTROL IN MINE	PCM	DSE	333003	-	-	-	2	-	2	2	-	-	-	-	25	10	25@	10	50	20	100		
	APPLICATION OF IT IN MINING	AIM	DSE	333004	60	-	-	2	-	2	2	-	-	-	-	25	10	25@	10	50	20	100		

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						Practical																	
						CL	TL	LL					FA-TH	SA-TH	Total	FA-PR	SA-PR	SLA					
																			Max	Max		Max	Min
Total					62	20	1	13	6		40		210	490	700		250		225		225		1400

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.
8. Industrial training shall be completed in summer vacation after Second year.

Course Category : Discipline Specific Course Core (DSC) , Discipline Specific Elective (DSE) , Value Education Course (VEC) , Intern./Apprenti./Project./Community (INP) , Ability Enhancement Course (AEC) , Skill Enhancement Course (SEC) , Generic Elective (GE)

MINE LEGISLATION AND MANAGEMENT**Course Code : 333301****Programme Name/s : Mining & Mine Surveying/ Mining Engineering****Programme Code : MS/ MZ****Year : Third****Course Title : MINE LEGISLATION AND MANAGEMENT****Course Code : 333301****I. RATIONALE**

A Mining Engineer must know the provisions contained in the Mines Act, Rules and Regulations, as his prime responsibility is to ensure that the operations under his charge are carried out as per the provisions of these laws. He should also be able to carry out operations taking proper precautions to avoid accidents. He should be able to make inspections of various places under his charge. As a supervisor he shall be required to know the basics of recruitment, manpower management and training rules applicable to mining industry. The course covers these aspects of legislation, safety and management, pertaining to certain provisions of the above statute.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply different provisions contained in the Mines Act, Rules and Regulations with respect to safety of men and machinery.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Follow the provisions of Mines Act & Rules while working in mines.
- CO2 - Supervise and enforce compliance of provisions of Coal Mine Regulations 2017.
- CO3 - Apply preventive measures to avoid mine accidents.
- CO4 - Supervise shop floor activities in mines.
- CO5 - Inspect various transporting systems, old working and rescue work in underground mines.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme													Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL				
															Practical								
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA				
							Max	Min							Max	Min	Max	Min	Max	Min			
333301	MINE LEGISLATION AND MANAGEMENT	MLS	DSC	3	1	-	-	4	4	1.5	30	70*#	100	40	25	10	25#	10	-	-	150		

Total IKS Hrs for Sem. : Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Apply the proper provisions of mines act for a given situation. TLO 1.2 Apply the provisions of mines rules under given conditions.	Unit - I Mines Act & Mines Rules 1.1 Important provisions under Mines Act, 1952 (as amended from time to time): (a) Definitions (sec. 2), (b) Committees (sec. 12 to 14), (c) Provision as to health and safety (sec. 19 to 25), (d) Hours and limitation of employment (sec. 28 to 48), (e) Leave with wages (sec. 50 to 56). 1.2 Important provisions under Mines Rules, 1955: (a) Health and sanitation provisions, (b) First-aid and medical appliances, (c) Employment of persons, (d) Welfare amenities.	Lecture Using Chalk-Board Presentations

MINE LEGISLATION AND MANAGEMENT**Course Code : 333301**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Select the proper term for a given description. TLO 2.2 Identify the duties and responsibilities of mines employees. TLO 2.3 Apply the safety provisions w.r.t. mine opening under given condition. TLO 2.4 Compare the precautionary measures between given transport system. TLO 2.5 Apply the safety provisions while working in mines under given condition. TLO 2.6 Select the suitable safety practices while adopting given mechanization in mines production process.	Unit - II Coal And Metalliferous Mines Regulations 2.1 Important definitions. 2.2 Duties and responsibilities of: (a) Owner, Contractor, (b) Persons employed in mines, Competent person, (c) Mines Manager, Safety officer, Overman / Foreman, Sirdar / Mine Mate, Shotfirer / Blaster, Surveyor, Magazine In-charge, (d) HEMM operators. 2.3 Important provisions under chapter: (a) Plans and sections, (b) Means of access and egress. 2.4 Important provisions under chapter: (a) Winding in shaft, (b) Haulage. 2.5 Important provisions under chapter: (a) Mine working, (b) Danger from fire, dust, gas & water, (c) Ventilation, (d) Lighting & safety lamps. 2.6 Important provisions under chapter: (a) Explosives & shorfiring / blasting, (b) Machinery, plant & equipment.	Presentations Lecture Using Chalk-Board
3	TLO 3.1 Identify the given type of mine accident. TLO 3.2 Identify the preventive measures to avoid the recurrence of dangers under the given situation in mines. TLO 3.3 Compare the various functions of given safety organizations working for mines. TLO 3.4 Identify the given safety awareness program.	Unit - III Mine Accidents & Safety 3.1 Accidents: (a) Unsafe act and unsafe conditions, (b) Types or categories of mine accidents, (c) Classification of mine accidents. 3.2 Causes and prevention of mine accidents due to: (a) Roof/Side fall, (b) Explosives and blasting, (c) Haulage and winding. 3.3 Mine Safety Organization: (a) External safety organization, (b) Internal safety organization, (c) Workmen's Inspector, Duties of Workmen's Inspector, Action on the report of Workmen's Inspector. (d) Pit safety committee, its scope, composition, function, etc. 3.4 3.4 Safety audit and safety campaign.	Lecture Using Chalk-Board Presentations

MINE LEGISLATION AND MANAGEMENT**Course Code : 333301**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Identify the given type of mine organization. TLO 4.2 Apply the proper function of industrial leadership best suited for given situation. TLO 4.3 Find the proper process to improve the productivity of mining operation. TLO 4.4 Identify the given method of wage and payment. TLO 4.5 Justify the role of trade union for a given situation in the mining industry.	Unit - IV Management 4.1 Organization: (a) Types: Line, Staff, Line & Staff organization. (b) Examples of various business organizations, like Coal India Ltd, MOIL Ltd, and Typical underground/surface coal/metal mine organization. 4.2 Leadership: (a) Qualities of good supervisors, (b) Functions of industrial leadership, (c) Delegation of authority and its importance 4.3 Time study & Motion study: (a) Principles, (b) Aim / objectives. 4.4 Wage and payment: (a) Essentials of good wage system, (b) Types of wages, (c) Methods of payment. 4.5 Trade Union: (a) Functions of trade union, (b) Strike, Lockout, Lay off.	Lecture Using Chalk-Board Presentations
5	TLO 5.1 Select the proper precautionary measures as per DGMS circulars under given conditions. TLO 5.2 Apply the suitable safety inspection procedures for given working conditions. TLO 5.3 Apply the proper rescue work procedure when an emergency arises at mines.	Unit - V Circulars, Inspection Procedures & Mines Rescue Rules 5.1 Circulars, Bylaws & Standing orders: (a) Difference between Circulars, Bylaws & Standing orders, (b) Model standing order in the event of stoppage of main mechanical ventilator, (c) Precautions regarding Blown through shots. 5.2 Inspection Procedures for: (a) Old working, (b) Goaf area, (c) Haulage roadway, (d) Winding rope. 5.3 Selected provisions under Mines Rescue Rules 1985: (a) Rescue organization and equipment in mines, (b) Conduct of rescue work.	Lecture Using Chalk-Board Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Read the provisions of leave with wages as per Mines Act 1952 and interpret the same by preparing a sample case study report as per given situation.	1	Interpretation of provisions of Leave with Wages as per Mines Act 1952.	4	CO1
LLO 2.1 Read the provisions of First aid room and first aid station as per Mines Rule 1955 and prepare the list of equipment to be kept there.	2	List of equipment to be kept in First aid room and first aid station as per Mines Rule 1955	2	CO1
LLO 3.1 Read the provisions of mines plan and sections as laid down in CMR 2017 and prepare notes on types of plans to be maintained at mines.	3	Types of mine plans to be maintained in mines as per CMR 2017.	4	CO2
LLO 4.1 Make an SOP for drilling and blasting operations carried out in mines (underground as well as opencast mines) as per the provisions given in CMR 2017.	4	SOP for drilling and blasting operations carried out in mines	4	CO2

MINE LEGISLATION AND MANAGEMENT**Course Code : 333301**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 5.1 Interpret the provisions of misfire as laid down in CMR 2017 with a suitable example.	5	Provisions of misfire as laid down in CMR 2017	2	CO2
LLO 6.1 Interpret the standards of ventilation in underground mines with a suitable example.	6	Standards of ventilation in underground mines	2	CO2
LLO 7.1 Draft a safety audit procedure for a particular mine.	7	Safety Audit procedure	4	CO3
LLO 8.1 Prepare comparative notes on Time study Vs Motion study by giving proper examples.	8	Time study Vs Motion study	2	CO4
LLO 9.1 Prepare comparative notes on authority & responsibility by giving proper examples.	9	Authority & Responsibility	2	CO4
LLO 10.1 Make an SOP for the inspection of haulage roadway.	10	SOP for the inspection of haulage roadway.	2	CO5
LLO 11.1 Prepare a sample schedule and standard procedure for the inspection of sealed off area.	11	Standard procedure for the inspection of sealed off area.	2	CO5
LLO 12.1 Prepare the list of equipment to be kept at Fresh air base as per provisions given in Mines Rescue Rules 1985.	12	List of equipment to be kept at Fresh air base as per Mines Rescue Rules 1985.	2	CO5
Note : Out of above suggestive LLOs - • '*' Marked Practicals (LLOs) Are mandatory. • Minimum 80% of above list of lab experiment are to be performed. • Judicial mix of LLOs are to be performed to achieve desired outcomes.				

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Prepare a visit report on any nearby underground mine (coal/metal) to find out the process of gassiness of mine.
- Prepare a report of any nearby mines regarding their organization chart and functioning of pit safety committee.
- Prepare a report of internal safety organization of CIL, MOIL, SAIL etc.
- Collect the information from websites of DGMS/Mining Industries/DMS offices/IBM/News papers on Mines safety and Submit hand written report of 5 to 10 pages.
- Prepare a report on various trade unions engaged in Indian mining industry.
- Prepare a report on welfare amenities provided by mine management by visiting nearby mines.
- Prepare a report on emergency dealing procedure of nearby mines.
- Prepare a report on incentive methods and procedures given to employees at your nearby mines.
- Prepare and present a case study of a mines accident enquiry report.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	No laboratory equipment as it is a theory subject	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Mines Act & Mines Rules	CO1	10	2	4	4	10
2	II	Coal And Metalliferous Mines Regulations	CO2	30	4	8	10	22
3	III	Mine Accidents & Safety	CO3	15	2	4	6	12
4	IV	Management	CO4	15	2	2	8	12
5	V	Circulars, Inspection Procedures & Mines Rescue Rules	CO5	20	2	4	8	14
Grand Total				90	12	22	36	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- progressive test 1
- progressive test 2
- Tutorial submission

Summative Assessment (Assessment of Learning)

- End year exam
- Viva-voce
- End year exam

XI. SUGGESTED COS - POS MATRIX FORM

MINE LEGISLATION AND MANAGEMENT**Course Code : 333301**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3				2		3			
CO2	3	3	2		3		3			
CO3	3	3	2		3		3			
CO4	3	2			3		3			
CO5	3	3	2		3		3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
 *PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Central Government	Mines Act 1952 (latest edition/amended)	Lovely Prakashan, Dhanbad
2	Central Government	Mines Rules 1955 (latest edition/amended)	Lovely Prakashan, Dhanbad
3	Central Government	Coal Mines Regulations 2017 (latest edition/amended)	Lovely Prakashan, Dhanbad
4	Central Government	Mines Rescue Rules 1985 (latest edition/amended)	Lovely Prakashan, Dhanbad
5	Central Government	DGMS Circulars	Lovely Prakashan, Dhanbad
6	S. Ghatak	A Study of Mine Management Legislation and General Safety	Coalfield Publishers 'SKYLARK' J. C. Bose Lane, Asansol – 713302.
7	S. D. Prasad & Rakesh	Legislation in Indian Mines: A Critical Appraisal (Volume - I & II)	Vivek P-8, New Medical Enclave. B.H.U., Varanasi – 221005.
8	L. C. Kaku	Some aspects of Mine Management, Legislation & Safety	Lovely Prakashan, Dhanbad

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.slideshare.net/in	Indian Mine Legislation
2	www.youtube.com	mine accidents and safety
3	www.discoveryforengineers.com	History of Mining Legislation in India
4	www.dgms.gov.in	DGMS Regulatory Authority
5	http://www.infomine.com/library/publications	Mine Management

MINE LEGISLATION AND MANAGEMENT**Course Code : 333301**

Sr.No	Link / Portal	Description
Note : Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students		

MSBTE Approval Dt. 02/07/2024**Semester - 3, K Scheme**

SURFACE MINING**Course Code : 333302****Programme Name/s : Mining & Mine Surveying/ Mining Engineering****Programme Code : MS/ MZ****Year : Third****Course Title : SURFACE MINING****Course Code : 333302****I. RATIONALE**

After obtaining Diploma in Mining and Mine surveying/Mine Engineering/Mining Engineering Diploma Engineer required to supervise operations involved in surface mines. The numbers of surface mines are increasing to enhance production rate and due to present policy of linking large opencast mines to the super thermal power plant. Thus Diploma engineer must have knowledge of unit operations involved in production process, type of machineries used, their applicability and working, knowledge of explosive used and procedure for carrying out blasting operation in large highly mechanized surface mines by deep hole blasting. All these are essential aspects are included in the course Surface Mining in Third year of the programme.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Select suitable Layout for Surface Mining and evaluate the environmental impact assessment caused due to such mining operations.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Apply the basic concept of selection of surface mining over underground mining.
- CO2 - Supervise operations involved in the surface mining both coal and non coal.
- CO3 - Supervise the operations of the various machineries used in surface mines.
- CO4 - Select suitable explosive for deep hole blasting in highly mechanized surface mines.
- CO5 - Supervise blasting operation to give the optimum results from the blast.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

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															Practical						
				CL	TL	LL	FA-TH				SA-TH		Total		FA-PR		SA-PR		SLA		
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min												
333302	SURFACE MINING	SME	DSC	3	-	-	-	3	3	3	30	70	100	40	-	-	-	-	-	-	100

Total IKS Hrs for Sem. : Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

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4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
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V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Classify the various surface mining methods. TLO 1.2 Select proper surface mining method over given parameters. TLO 1.3 Illustrate the various terminologies used in design of surface mine. TLO 1.4 Apply precautionary measures to avoid given slope failure.	Unit - I Basic Concepts Of Surface Mining 1.1 Classification of surface mining methods, classification based on mechanization. 1.2 Factors affecting choice of surface mining methods, Advantages and disadvantages of surface mining, Stripping ratio: overall stripping ratio, Break even stripping ratio. 1.3 Elements of Benches: Height, width, angle of slope, toe, crest, statutory provisions regarding height, width, angle of slope etc. 1.4 Bench Slope failures: Types, causes & prevention.	Lecture Using Chalk-Board Model Demonstration Presentations

SURFACE MINING**Course Code : 333302**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Describe given unit operations of surface mining production process. TLO 2.2 Describe the given method of opening of an outcropping or shallow depth deposit. TLO 2.3 Describe the given overburden removal method. TLO 2.4 Design a surface mine layout under given conditions.	Unit - II Surface Mines Layouts 2.1 2.1 Unit operations involved in production process: • Site preparations, • Drilling & blasting, • Removal of overburden, • Loading & transportation • Reclamation. 2.2 2.2 Method of opening up of deposit: • Boxcut, • Entries into opencast mines – single entry, double entry & spiral entry system. 2.3 2.3 Overburden excavation: • Classification of OB removal methods, • Overcasting by dragline, shovel & multi-bucket excavator. • Disposal of overburden. 2.4 2.4 Surface Mine Layouts: • Factors determining choices of layout, • Sample layouts for limestone, copper, coal, iron ore deposits explaining the method of work, machineries required, manpower, OMS etc.	Lecture Using Chalk-Board Video Demonstrations Presentations

SURFACE MINING**Course Code : 333302**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Classify the surface mining equipment for the given application. TLO 3.2 Describe the given drilling machine. TLO 3.3 Select proper excavating equipment under given condition. TLO 3.4 Describe the choice of transporting equipment. TLO 3.5 Describe given miscellaneous equipment. TLO 3.6 Follow the precautionary measures for given HEMM. TLO 3.7 Select In-pit crushing system under given condition.	Unit - III Surface Mining Machinery 3.1 Classification of surface mining machineries, factors affecting the selection of excavating and haulage equipment, effects of selecting larger size equipment. 3.2 Working principle, application, advantages & disadvantages of productive drilling machines: • Rotary drill machine, • Percussive drill machine. 3.3 Working principle, application, advantages & disadvantages of excavators: • Shovels: primary motions, operating parameters, rope shovel, hydraulic shovel. • Dragline, • Front end loader • Backhoe excavator. • Multibucket excavators: bucket wheel & bucket chain excavator, working method of BWE (terrace cut & dropping cut). • Surface Miner. 3.4 Working principle, application, advantages & disadvantages of transporting equipment : • Rear discharge dumper. 3.5 Working principle, application, advantages & disadvantages of equipment: • Scraper • Ripper & dozer • Motor grader • Compactor (roller) • Rock breaker. 3.6 Safety devices used in HEMM, precautionary measures while use of HEMM. 3.7 In-pit crushing system: • Semi-mobile crusher • Mobile crusher.	Lecture Using Chalk-Board Video Demonstrations Presentations

SURFACE MINING**Course Code : 333302**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 4a. Describe the given type of explosives used in opencast mines. TLO 4.2 Apply the various precautionary measures for given system of bulk explosives. TLO 4.3 Select proper initiation system for given type of explosives to initiate the blast.	Unit - IV Opencast Explosives 4.1 Explosives used in opencast mines: • Main ingredients of explosive • Classification of explosives • ANFO: composition, properties, precautions while mixing-handling-use. • Composition & properties of Slurry explosives, Emulsion explosives, Heavy ANFO, Booster. 4.2 Bulk explosive systems, composition, properties: • Plant mix slurry/emulsion • Site mix slurry/emulsion • Repumpable slurry/emulsion. • Conditions for using bulk explosives. • Transport of Explosives in bulk. 4.3 Application of Initiation system of explosives: • Safety fuse & plain detonator • Detonating fuse & detonator • Nonel (shocktube) • Electronic detonators & their firing system • Wireless Electronic Detonators.	Lecture Using Chalk-Board Presentations Model Demonstration Video Demonstrations

SURFACE MINING**Course Code : 333302**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Design a surface mine blast under given condition. TLO 5.2 Describe the various precautions observed during given blasting techniques. TLO 5.3 Select the proper control blasting technique based on given parameters. TLO 5.4 Select the precautionary measures to avoid the given environmental impact due surface mining operations.	Unit - V Blasting Practice In Surface Mines 5.1 Blast design: • Theory of rock fragmentation by blasting, • Need for blast design, Factors to be considered while blast designing. • Blasthole geometry: bench height, hole diameter, spacing, burden, stemming, subgrade drilling, explosive charge, specific charge, powder factor, delay interval and initiation sequence. • Blast design for the bench of surface mine (Simple numerical). 5.2 Blasting techniques: • Single row blasting pattern • Multiple row blasting pattern • Deep hole blasting: Precautions while drilling, charging and blasting of deep holes. • General safety measures for blasting practices. • Secondary blasting: pop shooting & plaster shooting. 5.3 Controlled blasting techniques: • Line drilling • Trim (cushion) blasting • Pre-splitting • Deck charging • Muffled blasting. 5.4 Environmental impacts: • Ground vibration: measurement, causes & prevention. • Air blast & noise: causes & prevention. • Fly rock: causes & prevention. • Noise pollution: effects, causes & prevention. • Degradation of land.	Lecture Using Chalk-Board Presentations Model Demonstration Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Present a report on Safety Code of Blasting as per IS 4081:2013.
- Present a case study report on application of blasting in civil engineering projects, like tunnels, demolitions of old buildings, etc.
- Visit nearby surface mine and present a report on various steps taken by mine management to protect the environment from surface mine impacts.
- Present a report of about explaining the complete mines layout by visiting any nearby mines of coal/metal/stone quarry.

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- Present a report on various permissions required from DGMS/State Authorities for use of ANFO explosives.
- Present a report on explosives manufacturing process by visiting a nearby explosive manufacturing plant.
- Visit nearby surface mine and present a complete report on drilling & blasting process followed there as well every kaizen regarding improvement of blasting performance compared to previous blast.
- Prepare a report on monsoon planning while working with an opencast working. Explain with a case study or visit nearby mine.
- Present a report on Salient features of environment protection Act, Environment Impact Assessment and Environmental Management Plan.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	No laboratory equipment as it is a theory subject	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basic Concepts Of Surface Mining	CO1	12	2	4	4	10
2	II	Surface Mines Layouts	CO2	16	2	4	6	12
3	III	Surface Mining Machinery	CO3	26	2	8	10	20
4	IV	Opencast Explosives	CO4	16	2	4	6	12
5	V	Blasting Practice In Surface Mines	CO5	20	2	4	10	16
Grand Total				90	10	24	36	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Progressive test 1
- Progressive test 2

Summative Assessment (Assessment of Learning)

- End year exam

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3		2		3		3			
CO2	3	3	3		3		3			
CO3	3	2	2		3		3			
CO4	3				3		3			
CO5	3	3	3		3		3			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	S.K. Das	Surface Mining Technology	Lovely Prakashan,Dhanbad
2	S.K. Das	Explosive and Blasting Techniques	Lovely Prakashan,Dhanbad
3	G.B. Misra	Surface Mining	Oxford University Press, Calcutta
4	G.B. Misra	Explosive and Blasting Techniques	Mintech Publication Bhubaneshwar.
5	G. K. Pradhan	Drilling & Blasting	Mintech Publication Bhubaneshwar.
6	R. T. Deshmukh	Opencast Mining	Lovely Prakashan, Dhanbad.
7	D. J. Deshmukh	Elements of Mining Technology Vol-I	Central Techno Publication, Nagpur
8	R. D. Singh	Principles & Practices of Modern Coal Mining	New Age International (P) Limited, Publishers, New Delhi. ISBN: 81-224-0974-1
9	Sushil Bhandari	Engineering Rock Blasting Operations	A. A. Balkema Publishers, Old post road, Brookfield, VT 05036 (USA). ISBN 9054106581
10	Central Government	Ammonium Nitrate Rules 2012 (latest edition/amended)	Lovely Prakashan,Dhanbad
11	S. D. Prasad & Rakesh	Legislation in Indian Mines: A Critical Appraisal (Volume - I & II)	Vivek P-8, New Medical Enclave. B.H.U., Varanasi – 221005.
12	L. C. Kaku	Some aspects of Mine Management, Legislation & Safety	Lovely Prakashan,Dhanbad

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.slideshare.net.in	Surface Mining Machineries
2	https://www.youtube.com	Surface Mining Machineries

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Sr.No	Link / Portal	Description
3	http://www.mining-journal.com/	Surface Mining Technology
4	http://www.mining-technology.com/	Surface Mining Operations
5	http://www.infomine.com/library/publications	Surface Mining Operations
Note : Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students		

MSBTE Approval Dt. 02/07/2024**Semester - 3, K Scheme**

ADVANCED MINE SURVEYING**Course Code : 333303****Programme Name/s : Mining & Mine Surveying/ Mining Engineering****Programme Code : MS/ MZ****Year : Third****Course Title : ADVANCED MINE SURVEYING****Course Code : 333303****I. RATIONALE**

the era In of globalization today, the technology has brought the significant advancement in surveying instruments and technology. Available precise digital surveying instruments are used currently due to their accuracy, speed and easy operation of the same. These equipment and the applications are extensively used in the field of mining engineering. A vital role of remote sensing and Geographical surveying (GIS) is widely used for plotting and storing spatial information. It is expected the students should know basics of the same in mining exploration. Through this course students will develop the desired skills and competencies which are expected from them for mine survey works.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Prepare plans, contour maps using Advanced Mine surveying equipment and technique for carrying different mining operations.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Plot plans using Theodolite surveys.
- CO2 - Find out distances and elevations using Theodolite in underground mine.
- CO3 - Set out simple circular curve.
- CO4 - Use Total Station instrument for preparing plan for mine site.
- CO5 - Use GPS to locate coordinates of stations.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks					
				Actual Contact Hrs./Week				SLH			NLH	Theory	Based on LL & TL				Based on SL									
													Practical													
													CL	TL	LL	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min																	
333303	ADVANCED MINE SURVEYING	AMS	DSC	3	-	2	-	5	5	3	30	70	100	40	25	10	25#	10	-	-	150					

Total IKS Hrs for Sem. : Hrs

Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the function of Mine Correlation TLO 1.2 Determine Shaft Survey in the given situation. TLO 1.3 Determine Joint Survey for the given data. TLO 1.4 Explain the principles of Tacheometric surveying. TLO 1.5 Use the tacheometer to determine Reduced level, horizontal and vertical distance in the given situation.	Unit - I Underground Mine Surveying 1.1 Definition & purpose of mine correlation, Different methods of correlation. weisbach method & weiss quadrilateral method 1.2 Determination of mean position of swing, Keeping a sinking shaft (down ward and upward) vertical; Inclined shafts- making and position of stations, setting up of instruments in the incline shaft 1.3 Definition of Joint Survey, Main features shown/Contents of joint survey plan, Utility of joint survey 1.4 Principle of tacheometry, Use of Tacheometry, Tacheometer and its component parts, Analytic lens, Tacheometric formula for horizontal distance with telescope horizontal and staff vertical. 1.5 Methods of Tacheometry: Stadia and fixed hair method, Limitations of tacheometry.	Video Demonstrations Presentations Collaborative learning Case Study

ADVANCED MINE SURVEYING

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Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Classify the curves used in surveying to fix the alignment. TLO 2.2 Draw the labelled diagram of simple circular curve. TLO 2.3 Derive the relationship between Radius and Degree of curve TLO 2.4 Set a simple circular curve using the relevant method of curve setting in the given situation.	Unit - II Curve Setting 2.1 Curve: Definition, Necessity of Curves, Types of curves used in roads and railway alignments. 2.2 Elements of simple circular curve, Designation of the curve by Radius and Degree of curve. 2.3 Radius and Degree of curve. 2.4 Setting out a simple circular curve by offsets from long chord and Rankine's method of deflection angles.	Presentations Video Demonstrations Hands-on Collaborative learning
3	TLO 3.1 Use the EDM to measure the distance between two given stations. TLO 3.2 Use Electronic Digital Theodolite to measure the required angle. TLO 3.3 Explain the procedure to measure the angle between the given lines using Total Station instrument. TLO 3.4 Undertake the site layout operation for the given building structure using Total Station instrument.	Unit - III Advanced Mine Surveying Equipment's 3.1 Electronic Distance Meter (EDM): Principle of Electronic Distance Meter (EDM), component parts and their Functions, use of EDM in Mining 3.2 Electronic Digital Theodolite: Construction and Features of Electronic Digital Theodolite, procedure of angle measurement. 3.3 Total Station: Introduction, component parts with their functions, and Applications of Total Station, Temporary adjustments, sources of errors in Total Station, Measurements of Horizontal angles, vertical angles, distances and coordinates using Total Station. Traversing, Profile Survey and Contouring with Total Station. 3.4 Building Mine Site layout using Total Station: Procedure.	Video Demonstrations Demonstration Hands-on Collaborative learning Case Study
4	TLO 4.1 Propose the relevant system of remote sensing to be used for the given situation. TLO 4.2 Describe the procedure to find out the coordinates of the given station using GPS. TLO 4.3 Use the GIS technology to solve the given civil engineering problem.	Unit - IV Remote sensing, GPS and GIS 4.1 Remote Sensing : Definition, Electro-Magnetic Energy, Active and Passive system, Applications of remote sensing in Mining, land use / Land cover, mapping, disaster management and Environment. 4.2 Global Positioning System: Introduction, Construction and use of Global Positioning System (G.P.S.) 4.3 Geographic Information System (GIS): Overview, Component, Sources of errors, applications, Software's in GIS.	Presentations Video Demonstrations Presentations Hands-on

ADVANCED MINE SURVEYING**Course Code : 333303**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Suggest the relevant method of aerial surveying for the given situation. TLO 5.2 Classify the type of drones as per DGCA TLO 5.3 Explain the principles of photogrammetry TLO 5.4 Explain the type of Photogrammetry. TLO 5.5 Specify the Merits and Demerits of Photogrammetry surveying. TLO 5.6 Use the photogrammetry techniques to solve Mining engineering problems.	Unit - V Drone Surveying and Photogrammetry 5.1 Aerial surveying: Definition, principle, uses, methods 5.2 DGCA Classification of Drones, Silent features of Drone Rules, 2021 as per DGCA. 5.3 Definition of photogrammetry, Basic Principles of Photogrammetry. Types of Photogrammetry: Terrestrial and Aerial Photogrammetry 5.4 Types of Photographs, Terminology in aerial surveying. 5.5 Merits and Demerits of Photogrammetry surveying 5.6 Applications of Photogrammetry in Mining Engineering.	Model Demonstration Hands-on Collaborative learning Demonstration Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use theodolite as a Tacheometer to determine the Tacheometric Constant	1	*Determine the Tacheometric Constant	2	CO1
LLO 2.1 Use theodolite as a Tacheometer to compute reduced levels and horizontal distances	2	*Determine reduced levels of given stations and horizontal distances by Tacheometric Method (Part I)	2	CO1
LLO 3.1 Use theodolite as a Tacheometer to compute reduced levels and horizontal distances	3	*Determine reduced levels of given stations and horizontal distances by Tacheometric Method (Part II)	2	CO1
LLO 4.1 Use the offsets from Long Chord Method to Set out a circular curve	4	*Setting out of a circular curve by offsets from Long Chord Method.	2	CO2
LLO 5.1 Apply the technique of Rankine's Method of Deflection Angles to Set out a circular curve	5	*Setting out a circular curve by Rankine's Method of Deflection Angles. (Project) (Part I). Plot the curve details on A1 size imperial drawing sheet.	2	CO2
LLO 6.1 Apply the technique of Rankine's Method of Deflection Angles to Set out a circular curve	6	*Setting out a circular curve by Rankine's Method of Deflection Angles. (Project) (Part II). Plot the curve details on A1 size imperial drawing sheet.	2	CO2

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Use EDM to measure horizontal and vertical distance	7	*Determine horizontal and vertical distance by using EDM.	2	CO3
LLO 8.1 Use theodolite as a joint survey	8	*Determine Horizontal and vertical angles using Electronic Digital Theodolite	2	CO3
LLO 9.1 Set out the circular curves by long chord method.	9	Setting up the Total Station instrument on site for surveying.	2	CO3
LLO 10.1 Use Total station instrument to measure horizontal, vertical and slope distances	10	*Determine horizontal, vertical and slope distances using Total station equipment (Part I)	2	CO3
LLO 11.1 Use Total station instrument to measure horizontal, vertical and slope distances	11	*Determine horizontal, vertical and slope distances using Total station equipment. (Part II)	2	CO3
LLO 12.1 Use Total station instrument to measure the given horizontal and vertical angles	12	*Determine horizontal and vertical angles using Total Station. (Part I)	2	CO3
LLO 13.1 Use Total station instrument to measure the given horizontal and vertical angles	13	*Determine horizontal and vertical angles using Total Station. (Part II)	2	CO3
LLO 14.1 Use Total station to determine Reduce Levels	14	*Determine the Reduced Levels of given stations (Minimum 10 station) (Part I)	2	CO3
LLO 15.1 Use Total station to determine Reduce Levels	15	*Determine the Reduced Levels of given stations (Minimum 10 station) (Part II)	2	CO3
LLO 16.1 Use Total Station to stack out station points on ground.	16	Stack out (transferring the data on ground) using Total Station (Part I)	2	CO3
LLO 17.1 Use Total Station to stack out station points on ground.	17	Stack out (transferring the data on ground) using Total Station (Part II)	2	CO3
LLO 18.1 Use Total station instrument to measure Reduced Level for given road profile project	18	Road profile of 100m length using Total Station instrument (Part I)	2	CO3
LLO 19.1 Use Total station instrument to measure Reduced Level for given road profile project	19	Road profile of 100m length using Total Station instrument (Part II)	2	CO3
LLO 20.1 Use Total station instrument to prepare contour plans	20	Contouring using Total Station instruments for the area of size 50 X 50 m	2	CO3
LLO 21.1 Use Total Station to prepare Mining site layout	21	*Prepare Mining site layout by using Total Station (Project) (Part I). Plot the project details on A1 size imperial drawing sheet.	2	CO3

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 22.1 Use Total Station to prepare Building site layout	22	*Prepare Mining site layout by using Total Station (Project) (Part II). Plot the project details on A1 size imperial drawing sheet.	2	CO3
LLO 23.1 Use Total station to carry out five-sided closed traverse Surveying Project	23	*Carry out 5-Sided closed traverse Surveying project by using Total Station.(Project) Part I). Plot the traverse details on A1 size imperial drawing sheet.	2	CO3
LLO 24.1 Use Total station to carry out five-sided closed traverse Surveying Project	24	*Carry out 5-Sided closed traverse Surveying project by using Total Station. (Project) Part II). Plot the traverse details on A1 size imperial drawing sheet.	2	CO3
LLO 25.1 Use GPS technology to locate the coordinates of a station	25	*Locate the coordinates of a station with the help of GPS.	2	CO3
LLO 26.1 Develop the contour maps using photogrammetry images	26	Create the images of contouring map with given data (Photogrammetry images, etc) using the freeware/open source software (Part I)	2	CO4
LLO 27.1 Develop the contour maps using photogrammetry images	27	Create the images of contouring map with given data (Photogrammetry images, etc) using the freeware/open source software (Part II)	2	CO5
LLO 28.1 Develop the Mine Roadway Profile plan using photogrammetry images	28	Create the images of Mine Roadway Profile plan with given data (Photogrammetry images, etc) using the freeware/open source software (Part I)	2	CO5
LLO 29.1 Develop the Road Profile plan using photogrammetry images	29	Create the images of Mine Roadway Profile plan with given data (Photogrammetry images, etc) using the freeware/open source software (Part II)	2	CO5
LLO 30.1 Use relevant software for preparation of contour maps using given image data	30	*Write a brief report on the visit to nearby mine area, surveying software laboratory for visualization of image creation of contouring map of given area using data collected by drone technology / Arrange Expert Lecture / Show study videos of Photogrammetry surveying	2	CO5
Note : Out of above suggestive LLOs - • '*' Marked Practicals (LLOs) Are mandatory. • Minimum 80% of above list of lab experiment are to be performed. • Judicial mix of LLOs are to be performed to achieve desired outcomes.				

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Set the profiles of curves at the changes in alignment of road in the premises of the institute.
- Download specifications for Total station/ EDM/GPS/Micro optic theodolite and make a chart
- Prepare daily report of horizontal and vertical distance measurement using GPS / EDM/ Total station.
- Collect the relevant technical and commercial information of advanced survey instruments available in the market with specifications.
- Carry out comparative study of following survey instruments of different make and brands: Total station/ EDM/GPS/Micro optic theodolite.

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- Determine the reduced levels of the existing structures like lintels, chajja, slab, and beam using Theodolite and Total station in a multi-storied building and compare the results.
- Prepare a plan of surveyed using Total station.
- Prepare profile leveling using 360 degree leveler.
- Perform Drone survey of given mining area.

Assignment

- Measure the height of the flag post in your institute using Theodolite as tachometer
- Use freeware or open source software for image processing using photogrammetry principles
- Search and download the freeware/open source software and prepare a report stating the applications.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Twenty second transit theodolite with accessories	1,2,3,4,5,6,7
2	Electronic digital theodolite with accessories .	11,12
3	Electronic distance meter (+ or – 2 mm accuracy) with accessories	13,14
4	Total station (Magnification : 30x, Least Count : 1", Accuracy : 5", Distance Measuring Range without Prism: 0.3 - 800 M)	15,16,17,18,19,20,21,22,23,24,25,26,27
5	Electronic distance meter (+ or – 2 mm accuracy) instrument with accessories	20,21,22,23,24,25,26,27,28,29,30
6	GPS Instrument (H72)	28,29,30
7	One second micro optic theodolite with accessories	8,9,10

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Underground Mine Surveying	CO1	20	2	8	6	16
2	II	Curve Setting	CO2	16	2	4	6	12
3	III	Advanced Mine Surveying Equipment's	CO3	20	2	8	6	16
4	IV	Remote sensing, GPS and GIS	CO4	18	4	4	6	14
5	V	Drone Surveying and Photogrammetry	CO5	16	4	4	4	12

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Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
Grand Total				90	14	28	28	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- progressive test 1
- progressive test 2
- lab performance
- Journal submission

Summative Assessment (Assessment of Learning)

- Viva-voce
- End year exam

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	1	1	2	1	2			
CO2	3	2	2	1	1	1	2			
CO3	3	2	1	2	1	1	2			
CO4	3	1	2	2	2	2	2			
CO5	3	2	1	2	2	1	2			
Legends :- High:03, Medium:02,Low:01, No Mapping: -										
*PSOs are to be formulated at institute level										

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Kanetkar, T. P. and Kulkarni, S. V	Surveying and Levelling Part I and II	Pune Vidyarthi Gruh Prakashan, Pune; ISBN: 13: 9788185825007
2	Basak, N. N	Surveying and Levelling	McGraw Hill Education (India) Pvt. Ltd.,Noida ISBN: 93-3290-153-8
3	Duggal, S. K.	Surveying and Levelling Part I and II	Tata McGraw Hill Education Pvt. Ltd., Noida. ISBN:13: 978- 1259029837

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Sr.No	Author	Title	Publisher with ISBN Number
4	Saikia, M D; Das B.M. and Das, M.M.	Surveying	PHI Learning Pvt. Ltd., New Delhi ISBN: 978-81-203-3985-9
5	Subramanian, R.	Surveying and Levelling Part I and II	Oxford University Press. New Delhi ISBN 13:978-0-19-808542-3
6	New Punmia, B.C.; Jain, Ashok Kumar and Jain Arun Kumar.	Surveying Vol. I and surveying vol.II	Laxmi Publications Pvt. Ltd., New Delhi ISBN: 13: 9788170088837
7	Rao, P. Venugopala Akella, Vijayalakshmi	Textbook of surveying	PHI Learning Pvt. Ltd., New Delhi ISBN: 978-81-203-4991-9
8	Venkatramaiah, C	Textbook of surveying	Universities Press, Hyderabad ISBN: 978-81-737-1021-6
9	Anderson, James Mand Mikhail, Edward M.	Surveying theory and practice	Mc Graw Hill Education, Noida ISBN: 13-978-1-25-902564-8
10	De, Alak	Plane surveying	S. Chand Publications, New Delhi ISBN: 9788121917803

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/QtEkZPEeeZk?si=du-TF5NWb8LIH3J3	Total station set up,
2	https://youtu.be/KQgq5xqSTUw?si=eKOkFPUqsY-vFkSe	Theodolite Surveying lecture
3	https://youtu.be/zcRs3KTQzN0?si=cET6aHQUYK_MQIV	theodolite survey
4	https://youtu.be/Dj06aUJ9Wjc?si=I7c0YaEzdZuns-kp	Module 03-E: Circular Curves
5	https://youtu.be/H2AQq2jshgg?si=eN3SWmZfaiLjaWLj	SETTING UP A TOTAL STATION
6	https://youtu.be/J6j_sJyyudI?si=qF04e4bgpFPe79iA	How to Find Your Position on a Topo Map Using a GPS & UTM

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 02/07/2024**Semester - 3, K Scheme**

MINE ENVIRONMENT**Course Code : 333304****Programme Name/s : Mining & Mine Surveying/ Mining Engineering****Programme Code : MS/ MZ****Year : Third****Course Title : MINE ENVIRONMENT****Course Code : 333304****I. RATIONALE**

Mining is the hazardous profession involving fires, explosions of firedamp and coal dust, inundation of water are the common hazards which have resulted in calamities causing deaths of large number of miners all over the world. Therefore the mining engineer should be aware of hazards, their causes and methods of preventing them.

However, whenever such calamities do occur, rescue and recovery operations are necessary to save the life and property in mines. The mining engineer has to be well acquainted with these operations. The subject of Mine Environment covers topics on these activities.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competencies through various teaching learning experiences.

Apply precautionary measures against occurrence of mine fires , firedamp and coal dust explosions and undertake rescue & recovery operations in Underground Mines.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify and select appropriate fire extinguishers for different classes of fires.
- CO2 - Analyze gas sampling using Graham's ratio and Cowards Diagram.
- CO3 - Analyze and follow precautionary measures against mine explosions.
- CO4 - Follow safety measures against inundation and standards of lighting in mines.
- CO5 - Use of various mine rescue apparatus like Self contained breathing apparatus SCBA, Self Rescuers and communication devices.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												Total Marks	
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL				
				CL	TL	LL					Practical												
											FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA				
													Max	Min	Max	Min	Max	Min	Max	Min	Max		Min
333304	MINE ENVIRONMENT	MEV	DSC	3	-	2	-	5	5	3	30	70	100	40	25	10	25#	10	-	-	150		

MINE ENVIRONMENT**Course Code : 333304****Total IKS Hrs for Sem. : Hrs**

Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Use given portable fire extinguishers for particular class of fire. TLO 1.2 Explain factors governing spontaneous heating of coal. TLO 1.3 Enlist the different types of fire stoppings.	Unit - I Mine Fires 1.1 Surface fire and underground fires, their causes, detection and prevention. Classification of fires, Portable fire extinguishers their applicability, places of portable fire extinguishers in mines, maintenance of fire extinguishers. 1.2 Spontaneous heating: Mechanism of spontaneous Heating, factors governing spontaneous heating, methods for study of spontaneous combustion of coal: crossing point method. Stages of spontaneous heating, Detection of spontaneous heating: Physical or sensory indicators, Precautions for prevention of spontaneous heating. 1.3 Dealing with spontaneous heating & fires: Various methods, Sealing off: selection of site for fire stoppings, construction of fire stopping, fittings to stopping, inspection and maintenance of fire stoppings.	Lecture Using Chalk-Board Presentations Hands-on Demonstration Video Demonstrations
2	TLO 2.1 Explain different methods of sampling. TLO 2.2 Analyze the given gas sample using Cowards diagram. TLO 2.3 Choose a proper method for reopening of a sealed off area.	Unit - II Sampling Of Mine Atmosphere 2.1 Sampling from sealed off area: Sampling line, Methods of sampling from behind the fire stopping, frequency of sampling, Sampling accessible places: water, air displacement method, evacuated sample holder type. 2.2 Composition and behavior of gases in sealed off area, interpretation regarding condition of heating: Graham's ratio; interpretation regarding explosibility: Cowards Diagram. Elementary knowledge of gas chromatography. 2.3 Reopening of sealed off area: Factors governing decision of reopening, methods of reopening, selection of methods of reopening, precautions to be taken while reopening.	Lecture Using Chalk-Board Presentations Video Demonstrations

MINE ENVIRONMENT**Course Code : 333304**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Enlist the various causes of Fire damp explosion and its preventive measures. TLO 3.2 Enlist the various causes of coal dust explosion and its preventive measures. TLO 3.3 Justify the causes of failure of stone dust barrier.	Unit - III Mine Explosions 3.1 Mechanism of fire damp explosion, lag on ignition, Causes of fire damp explosion & its prevention. 3.2 Mechanism of Coal Dust explosion, factors governing explosibility of coal dust, Characteristics of coal dust explosion, Causes and Prevention of coal dust explosion. 3.3 Generalized stone dusting, Quantity of stone dust, Types and properties of stone dust, stone dusting plan, Stone dust barriers, types of stone, dust barriers, specifications and construction, location of primary and secondary types of barriers. Situations under which barrier may fail, maintenance and care of stone dust barriers. Water barrier, Triggered barrier.	Lecture Using Chalk-Board Video Demonstrations Presentations
4	TLO 4.1 Justify the causes of inundation due to surface & underground parameters. TLO 4.2 Various preventive measures while working in water logged area. TLO 4.3 Select proper illumination standards for mines.	Unit - IV Inundation & Mine Lighting 4.1 Surface and underground causes of Inundation and its prevention, water dams, bulkhead doors. 4.2 Procedure of and precaution while approaching old water logged areas, pattern of bore holes, Dewatering. 4.3 Standards of lighting in underground & opencast mines, LED Cap lamp, Cap lamp room	Lecture Using Chalk-Board Video Demonstrations Hands-on Presentations
5	TLO 5.1 Classify mine rescue apparatus. TLO 5.2 Select proper condition for using self-contained breathing apparatus, self-rescuers and pulmotor. TLO 5.3 Select proper site and equipments for fresh air base.	Unit - V Mine Rescue 5.1 Classification of mine rescue apparatus, modern self-contained breathing apparatus, its construction, application and scope. Common tests of self-contained compressed oxygen breathing apparatus. 5.2 Chemical oxygen self-rescuers, filter self-rescuers: their construction, application and limitations. 5.3 Fresh air base (FAB): location, personnel & equipments required. Layout of FAB. Resuscitation, Modern reviving apparatus.	Lecture Using Chalk-Board Video Demonstrations Presentations Hands-on Collaborative learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 To conduct mock drill session using suitable fire extinguishers.	1	Use different types of fire extinguishers for dealing with various classes of fires.	2	CO1
LLO 2.1 To understand the process for determining crossing point temperature of a coal sample.	2	Watch video clip for determining crossing point temperature of a coal sample and prepare a report.	2	CO1

MINE ENVIRONMENT**Course Code : 333304**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 3.1 To understand the process of construction of different types of stoppings.	3	Watch the video clip of various types of stoppings (wooden, sand bag, single brick, double brick and permanent) and prepare a report.	2	CO1
LLO 4.1 To carry out the sampling of air from behind the stopping by using different sampling equipments.	4	Identify the sampling equipments used for sampling of air from behind the stoppings.	2	CO2
LLO 5.1 Identification of sampling points.	5	Identify the sampling points for taking point samples in a given cross section.	2	CO2
LLO 6.1 To carry out water displacement method for collectiong gas sample from behind the sealed off area.	6	Watch the video clip of collecting gas samples by water displacement method.	2	CO2
LLO 7.1 To carry out direct circulation method for reopening of a sealed off area.	7	Prepare a report for reopening of a sealed off area by direct circulation method.	2	CO2
LLO 8.1 To carry out prior inspection method for reopening of a sealed off area.	8	Prepare a report for reopening of a sealed off area by prior inspection method.	2	CO2
LLO 9.1 To carry out Stage Method for reopening of a sealed off area.	9	Prepare a report for the Stage Method of reopening of a sealed off area.	2	CO2
LLO 10.1 Draw Cowards diagram for analyzing the explosibility of given gas sample.	10	Analyze the gas sample for explosibility of firedamp using Cowards diagram.	2	CO2
LLO 11.1 To understand the different parameters of construction of german type of stone dust barrier.	11	Watch the video clip of a German type of stone-dust barrier and prepare report.	2	CO3
LLO 12.1 To understand the different parameters of construction of polish type of stone dust barrier.	12	Watch the video clip of a Polish type of stone-dust barrier and prepare report.	2	CO3
LLO 13.1 To understand the different parameters of construction of water barrier.	13	Watch the video clip of a water barrier and prepare report.	2	CO3
LLO 14.1 To understand the different parameters of construction of Triggered barrier.	14	Watch the video clip of a Triggered barrier and prepare report.	2	CO3
LLO 15.1 Designing of a brick dam prototype to control inundation in a mine.	15	Design and demonstrate Brick dam prototype.	2	CO4
LLO 16.1 Designing of a Bulkhead door prototype to control inundation in a mine.	16	Design and demonstrate Bulkhead doors prototype.	2	CO4
LLO 17.1 To measure the intensity of light using lux meter.	17	Use luxmeter to measure intensity of light.	2	CO4
LLO 18.1 To understand the use of LED cap lamp.	18	Demonstrate the use of LED cap lamp.	2	CO4

MINE ENVIRONMENT**Course Code : 333304**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 19.1 To understand the procedure for approaching old water logged area.	19	Watch the video clip to approach Old water logged area and prepare report.	2	CO4
LLO 20.1 Use of self-contained breathing apparatus BG-4 for rescue operations.	20	Demonstrate the working of self-contained breathing apparatus BG-4	2	CO5
LLO 21.1 To understand the working of filter self-rescuer.	21	Demonstrate the working of filter self-rescuer.	2	CO5
LLO 22.1 To understand the working of reviving apparatus.	22	Demonstrate the working of reviving apparatus.	2	CO5
LLO 23.1 Learning the design aspects of an fresh air base.	23	Design a layout of fresh air base under given condition.	2	CO5
LLO 24.1 Using Fresh air hose type breathing apparatus.	24	Demonstrate the working of Fresh air hose type breathing apparatus.	2	CO5
Note : Out of above suggestive LLOs - • '*' Marked Practicals (LLOs) Are mandatory. • Minimum 80% of above list of lab experiment are to be performed. • Judicial mix of LLOs are to be performed to achieve desired outcomes.				

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Visit to any nearest mine and identify the causes and carry out the precautionary measures for Mine fires there.
- Perform case study of Mine fire in nearby coal mine or any mine with modern technology.
- Visit to any nearest mine and identify the causes and carry out the precautionary measures for Mine Explosion there.
- Visit to any nearest mine/Rescue Station and analyze the different Rescue apparatus and Recovery methods adopted there.
- Visit to any nearest mine and identify the causes and carry out the precautionary measures for Mine Inundation there.
- Visit to any nearest mine and present a report on mine lighting arrangement.
- Present a visit report of any nearby mines and identify the permanent stopping & its fitting.
- Visit to rescue station and submit a report on Gas Chromatography.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	CO2 extinguisher	1
2	Water CO2 extinguishers	1
3	Foam extinguisher	1
4	Dry powder extinguishers	1
5	Lux meter	22
6	Self-contained compressed oxygen breathing apparatus BG-4.	24
7	Chemical self-rescuer	25
8	Reviving apparatus care vent	26
9	Model of temporary stopping	3,4,5
10	Model of permanent stopping with fittings.	6
11	Different types of gas sample containers	7,8
12	Smart Classroom fitted with computer and DLP	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Mine Fires	CO1	18	2	4	10	16
2	II	Sampling Of Mine Atmosphere	CO2	18	2	4	10	16
3	III	Mine Explosions	CO3	20	2	4	10	16
4	IV	Inundation & Mine Lighting	CO4	16	2	4	4	10
5	V	Mine Rescue	CO5	18	2	4	6	12
Grand Total				90	10	20	40	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Progressive test 1
- Progressive test 2
- Lab performance
- Journal submission

Summative Assessment (Assessment of Learning)

MINE ENVIRONMENT**Course Code : 333304**

- Viva-voce
- End year exam

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3			3			1			
CO2	3	2		3						
CO3	3									
CO4	3		2	3						
CO5	3			3			3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
 *PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	D. J. Deshmukh	Elements of Mining Technology Vol-II	Dennet, Nagpur ISBN: 978-81-89904-34-0
2	G. B. Misra	Mine Environment and Ventilation	Oxford University Press ISBN: 0 19 562232 4
3	M. A. Ramlu	Mine Disasters and Mine Rescue	Oxford & IBH publishing Co. Pvt. Ltd New Delhi ISBN 81-204-0526-9
4	S. Ghatak	A Study of Mine Management Legislation and General Safety	Coalfield Publishers 'SKYLARK' J. C. Bose Lane, Asansol – 713302.
5	S. D. Prasad & Rakesh	Legislation in Indian Mines: A Critical Appraisal (Volume - I & II)	Vivek, P-8, New Medical Enclave. B.H.U., Varanasi – 221005.

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/7jmUnxbB_xQ?si=7hbBVhb8ZIPKvRYb	Types of Fire & Suitable Fire Extinguishers
2	https://youtu.be/WBZnAwfFBU0?si=IZvj-fAN3gJp05w9	Spontaneous Heating
3	https://youtu.be/M3pp28FZCfw?si=rSv6_FldNSmWBdII	Coward Diagram
4	https://youtu.be/6UUv2R-s7CY?si=QN3SIjNOX7tE1IZ	Coal dust explosion demonstration
5	https://youtu.be/KoXZgWEUNiw?si=rwN3AHa72Lvz4gWL	Drager Self Contained Breathing apparatus Model BG174
6	https://youtu.be/mMgv5v95_M0?si=2IMeHQYwzK0xHm_P	Sylvester Method
7	https://youtu.be/Ya5s46-tr6M?si=wn-dB8aOuLnKXC2k	Breathing Apparatus (BG-174)

MINE ENVIRONMENT**Course Code : 333304**

Sr.No	Link / Portal	Description
Note : Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students		

MSBTE Approval Dt. 02/07/2024**Semester - 3, K Scheme**

MINE MACHINERY**Course Code : 333305**

Programme Name/s : Mining & Mine Surveying/ Mining Engineering
Programme Code : MS/ MZ
Year : Third
Course Title : MINE MACHINERY
Course Code : 333305

I. RATIONALE

A large number of mining machineries are used in the mine right from the winding of men and material through shafts, transport of material, wire, power for drilling, cutting and loading of coal on the faces. Pumping operations are also essential to deal with accumulation of water in underground workings. A mining engineer should be aware of the types of Power cables used for different machines, so that they can supervise the selection, installation and day-to-day operation and elementary maintenance of these equipment.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

a. Different types of transport systems used in underground Mines. b. Different types of Winding systems used in shaft. c. Select the different types of wire ropes used in underground mines. d. Different types of Pumps used in underground Mines. e. Operation of different types of Power cables and Gate End Box used in underground mines

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify the different types of transport systems used in underground Mines.
- CO2 - Identify the different types of Winding systems used in shaft
- CO3 - Classify and select the different types of wire ropes used in underground mines
- CO4 - . Identify the different types of Pumps used in underground Mines.
- CO5 - Supervise the operation of different types of Power cables and Gate End Box used in underground mines

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SLH	NLH			Theory				Based on LL & TL				Based on SL		
															Practical						
				CL	TL	LL	FA-TH				SA-TH		Total		FA-PR		SA-PR		SLA		
															Max	Min	Max	Min	Max	Min	
333305	MINE MACHINERY	MMC	DSC	3	-	2	-	5	5	1.5	30	70*#	100	40	25	10	25#	10	-	-	150

Total IKS Hrs for Sem. : 1 Hrs

Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Classify the different types of Rope haulages used in Mines. TLO 1.2 Select the suitable type of the locomotive under different mining conditions. TLO 1.3 Identify the different types of Conveyors used in underground mines.	Unit - I Transportation of men and material in Underground Mines 1.1 Rope Haulage • types of underground transport: Main Haulage, Gathering Haulage • Description of each haulage system: Direct rope haulage, Endless rope haulage ,Main and Tail rope haulage, Gravity haulage, • Safety devices used on rope haulage system : Stop block/Buffers,Back stay ,Monkey catch ,Age craft Device ,Runaway Switch ,Drop Warwick ,Jazz Rails ,Retarders Pointer Plate 1.2 Locomotive Haulage • Locomotive Haulage different types/ Applicability: Diesel locomotive, Electric Locomotive Air compressed locomotive, Battery locomotives. Definition of draw bar pull, Ideal gradient, Super elevation. 1.3 Conveyors Different Types of Conveyor used in mines • Scraper Chain conveyor :Different parts of Scraper, Chain conveyor, Types on the basis of flexibility and on the basis of number of chains, Advantageous and limitations of Scraper Chain Conveyor • Belt Conveyor: Arrangement of belt conveyor, layout of face, gate and trunk conveyor in coal mine, different parts of belt conveyor, list of factors affecting selection of belt conveyor. ,Advantageous and limitations of belt conveyor	Video Demonstrations Model Demonstration Lecture Using Chalk-Board

MINE MACHINERY**Course Code : 333305**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Select the different equipment used for winding. TLO 2.2 Identify the different types of Winding. TLO 2.3 Identify the different components of Cage Suspension Gear And Keps	Unit - II Winding in Shafts 2.1 Equipment used for Winding • Purpose of Winding, Main equipment used for Winding, Head gear, Headgear pulley, Cage/Skip Winding Rope, Winding drum, Guides, Keps , Suspension Gear, Electric motor 2.2 Different types of Winding • Drum Winding Different types of Drum Winding, Cylindrical drum, Conical drum, Cylihydroconical drum, Bicydroconical drum, Provisions on winding drum, Flanges, Depth indicator, Mechanical Brakes (different types), Automatic Contrivance, Angle of fleet Guides different types , Rigid guides Flexible cable, Causes of cage oscillation • Koepe Winding (Friction Winding) Different types of Koepe Winding Ground mounted Koepe System, Tower mounted Koepe System 2.3 Cage Suspension Gear and Keps • Cage suspension Gear Rope Carpel, D link and bull chain, Safety hook ,Triangular distribution plate , Bridle chain, • Different types of keps Rigid keps , Davies improved keps gear	Video Demonstrations Model Demonstration Lecture Using Chalk-Board
3	TLO 3.1 Select the wire rope as per given mining condition. TLO 3.2 Identify the different types of Lays of Wire rope. TLO 3.3 Identify the different steps involved in Rope capping and rope splicing	Unit - III Steel Wire Ropes Used in Underground Mines 3.1 Different Types of WIRE ROPES • Typical analysis of wire rope steel, Classification of different types of wire ropes On the basis of use . 1) Standing Ropes 2) Running Rope On the basis of Construction 1) Stranded rope, Round Stranded Rope, Triangular Strand Rope or Flattened Strand Rope, Multi-Strand Rope 2) Non stranded rope, Half Locked Ropes , Full Locked Rope, Guide Ropes • Different types of Cores in wire rope – Fiber , wire rope , and IWRC 3.2 Different types of Lays of rope and their selection and maintenance • Right hand lay , left hand lay, Langs lay , ordinary lay , alternate lay ,advantages and disadvantages of different types of lays • Different definition like Space factor, static load, dynamic load, factor of safety. • Selection of wire rope , specification of wire rope, Mass and strength of wire ropes ,Care and maintenance in ropes, Types of deterioration in the ropes, Testing of wire ropes 3.3 Rope Capping and Rope Splicing • Types of Rope capping, White metal capping (cone socket type capel), Wedge type capping (Reliance rope capel), Capping with split capel and rivets (Split capel) • Recapping procedure , Rope splicing procedure	Video Demonstrations Model Demonstration Lecture Using Chalk-Board Demonstration Flipped Classroom Site/Industry Visit

MINE MACHINERY**Course Code : 333305**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 4a. Identify the different types of Reciprocating Pumps in Mines TLO 4.2 4b. Identify the different types of Centrifugal Pump. TLO 4.3 4c. Select the suitable type of face Pumps under given mining conditions.	Unit - IV Pumps used in Underground Mines 4.1 Different Types of Reciprocating Pumps • Sources of water in Mines, Classification of Mine Pumps Reciprocating Pump , Single acting ,Double acting, Three throw Ram pumps 4.2 Different Types of Centrifugal Pump • Centrifugal Pumps, Volute Pump ,Turbine Pumps Installation of pump , Operation of pump • Fitting on pump, foot valve, suction valve, delivery valve, retaining valve, air vessels, and air cock. Pressure gauge. • Starting and stopping of pump, Characteristics Curves of Centrifugal and turbine pumps. Snoring of pump, its prevention. Water hammer 4.3 Different Types of face Pump • Roto Pump ,Drill Operated portable pump	Video Demonstrations Model Demonstration Flipped Classroom Presentations Lecture Using Chalk-Board Site/Industry Visit
5	TLO 5.1 5a. Identify the different types of Cables TLO 5.2 5b. Carry out the operation of joining and repairing of cable. TLO 5.3 5c. Identify the various safety provisions in Gate end Box.	Unit - V Underground Power Cables and Gate End Box 5.1 Different Types of Power cables • Definition of Basic Fundamentals of electricity – Conductor, semiconductor , insulator, resistance, conductivity, inductance, capacitance, earthing, voltage , current Types of cables used in mines Permanent cable ,Different types, construction, Semi flexible cable Different types, construction Flexible cable ,Different types, construction 5.2 Joining and Repairing of Power Cable • Screening of cable, Cable joint box, Repair of cable, bleeding of cable, Cable care and maintenance during, Use and storage 5.3 Gate End Box • Construction of gate end box, Safety provision in gate end box, Pilot Circuit, Different circuits for protection Flame proof and Intrinsically safe devices definition and examples	Video Demonstrations Model Demonstration Presentations Lecture Using Chalk-Board Lecture Using Chalk-Board Site/Industry Visit

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Select the type of Direct rope Haulage to be installed for given output LLO 1.2 Draw and label the different parts of a) Single Drum Haulage and b) Double Drum Haulage	1	Performance of Single drum Direct rope haulage and double drum rope haulage.	2	CO1
LLO 2.1 Select appropriate type of Endless rope Haulage under given conditions , LLO 2.2 Prepare the neat sketch of identified type of tensioning arrangements and label it. LLO 2.3 Select the appropriate rope attachments for the over rope and under rope endless haulage LLO 2.4 identify different types of driving pulleys,	2	Performance of Over Rope Endless haulage and Under Rope Endless rope Haulage under given conditions	2	CO1

MINE MACHINERY**Course Code : 333305**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 3.1 Check the conditions of selecting Main and Tail rope Haulage and justify it	3	The working conditions of Main and Tail rope Haulage ,	2	CO1
LLO 4.1 Check the conditions of selecting Gravity rope haulage and justify it	4	The working conditions and applicability of Gravity rope Haulage	2	CO1
LLO 5.1 Select appropriate type of Safety device used on given Rope Haulage under given conditions LLO 5.2 Draw and lable Stop block/Buffers and justify its selection LLO 5.3 Draw and lable Back stay and justify its selection LLO 5.4 Draw and lable Monkey catch and justify its selection LLO 5.5 Draw and lable Age craft Device and justify its selection LLO 5.6 Draw and lable Runaway Switch and justify its selection LLO 5.7 Draw and lable Drop Warwick and justify its selection LLO 5.8 Draw and lable Jazz Rails and justify its selection LLO 5.9 Draw and lable Retarders and justify its selection LLO 5.10 Draw and lable Pointer Plate and justify its selection	5	Safety devices used on rope haulage system and its operation	2	CO1
LLO 6.1 Draw and lable the Exhaust Conditioner and flame trap of Diesel locomotive LLO 6.2 Expalin the working of Exhaust Conditioner and flame trap of Diesel locomotive	6	Exhaust Conditioner and flame trap of Diesel locomotive	2	CO1
LLO 7.1 Draw and lable the Different parts of Scraper Chain conveyor LLO 7.2 Justify the selection of scraper chain conveyor as tranporation mode in coal face	7	Scraper Chain conveyor as mode of transport in Coal Face.	2	CO1
LLO 8.1 Draw and lable the layout of belt conveyor in coal mine under given conditions LLO 8.2 Justify the advantages and disadvantages over rope haulage	8	Layout of Belt conveyor used for the transport from underground mine to surface .	2	CO1
LLO 9.1 Condition of suitability of Winding	9	Performance of Winding in underground shaft	2	CO2

MINE MACHINERY**Course Code : 333305**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 10.1 Compare Different types of Drum Winding. LLO 10.2 Draw and Label Cylindrical Drum Winder LLO 10.3 Draw and Label Conical Drum Winder LLO 10.4 Draw and Label Cylindro Conical Drum Winder LLO 10.5 Draw and Label Bi-Cylindro Conical Drum Winder	10	Different types of Drum Winding used in underground mining.	2	CO2
LLO 11.1 Explain Safety Provisions on winding drum. LLO 11.2 Draw and Label Depth Indicator LLO 11.3 Draw and Label Different types of Mechanical Brakes LLO 11.4 Draw and Label Automatic Contrivance LLO 11.5 Draw and Label Angle of fleet	11	Safety Provisions on winding drum .	2	CO2
LLO 12.1 Assemble the Different parts of Cage suspension Gear. LLO 12.2 Draw and Label Rope Carpel LLO 12.3 Draw and Label D link and Bull Chain LLO 12.4 Draw and Label Safety hook LLO 12.5 Draw and Label Triangular distribution plate LLO 12.6 Draw and Label Bridle chain	12	Cage suspension Gear used in Drum Winding.	2	CO2
LLO 13.1 Assemble Different parts of the keps LLO 13.2 Draw and Label Rigid keps LLO 13.3 Draw and Label Davies improved keps	13	Different types of keps	2	CO2
LLO 14.1 Compare Ground Mounted and Tower Mounted Koepe Winder LLO 14.2 Draw and Label Ground Mounted Koepe Winder LLO 14.3 Draw and Label Tower Mounted Koepe Winder	14	Different types of Koepe Winding used in underground mining.	2	CO2
LLO 15.1 Identify the different types of Stranded wire ropes from given Rope Samples. LLO 15.2 Draw and lable Round Stranded Rope LLO 15.3 Draw and lable Triangular Strand Rope or Flattened Strand Rope LLO 15.4 Draw and lable Multi-Strand Rope LLO 15.5 Draw and lable Flat Rope	15	Different types of Stranded rope (Cross Section)	2	CO3

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 16.1 Identify the different types of Non Stranded wire ropes from given Rope Samples LLO 16.2 Draw and label Locked Coil Rope or Full Locked Coil Rope LLO 16.3 Draw and label Half Locked Coil Rope LLO 16.4 Draw and label Guide ropes	16	Different types of Non Stranded rope (Cross Section)	2	CO3
LLO 17.1 Identify different types of Cores of Stranded wire rope Sample. LLO 17.2 Identify different types Lays of Stranded wire rope Sample. LLO 17.3 Draw and label the Fiber core LLO 17.4 Draw and label the wire rope core LLO 17.5 Draw and label IWRC LLO 17.6 Draw and label Right hand lay LLO 17.7 Draw and label left hand lay LLO 17.8 Draw and label Langs lay LLO 17.9 Draw and label ordinary lay LLO 17.10 Draw and label alternate lay	17	Different types of Cores and Lays of wire rope.	2	CO3
LLO 18.1 Identify the different types of Rope Capping from given Samples and explain different steps of Preparing different types of Rope Capping LLO 18.2 Draw and Label White metal capping (cone socket type capel) LLO 18.3 Draw and Label Wedge type capping (Reliance rope capel) LLO 18.4 Draw and Label Capping with split capel and rivets (Split capel)	18	Different types of Rope Capping	2	CO3
LLO 19.1 Demonstrate the different steps involved in Rope splicing procedure.	19	Different steps involved in Rope splicing procedure .	2	CO3
LLO 20.1 Identify the Different Types of Reciprocating Pumps (Cut Section) LLO 20.2 Draw and label Single acting LLO 20.3 Draw and label Double acting LLO 20.4 Draw and label Three throw Ram pumps	20	Different Types of Reciprocating Pumps.	2	CO4
LLO 21.1 Identify Different Types of Centrifugal Pump (Cut Section) LLO 21.2 Draw and Label Volute Pump LLO 21.3 Draw and Label Turbine Pumps	21	Different Types of Centrifugal Pump.	2	CO4
LLO 22.1 Identify the different Fittings on pump, foot valve, suction valve, delivery valve, retaining valve, air vessels, and air cock. Pressure gauge. LLO 22.2 Draw and Label foot valve, suction valve, delivery valve, retaining valve, air vessels, and air cock. Pressure gauge	22	Fittings on pump, .	2	CO4

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 23.1 explain Different Types of face Pump LLO 23.2 Draw and Label Roto Pump LLO 23.3 Draw and Label Drill Operated portable pump	23	Face Pump.	2	CO4
LLO 24.1 Identify the different types of Permanent cable from given Cable Samples (Cross Section) LLO 24.2 Draw and lable PILSDWA cable LLO 24.3 Draw and lable PILSSWA cable LLO 24.4 Draw and lable Vulcanized bitumen insulated cable LLO 24.5 Draw and lable Compound insulated cable	24	Different types of Types of Permanent cable (Cross Section).	2	CO5
LLO 25.1 Identify the different types of Semi Flexible cable from given Cable Sample LLO 25.2 Draw and lable cable used for belt conveyor LLO 25.3 Draw and lable cable used for rope haulage	25	Different types of Semi flexible cable (Cross Section)	2	CO5
LLO 26.1 Identify the different types of Flexible cable from given Cable Samples. LLO 26.2 Draw and lable 5 core A.C. Cable :- (collectively screened) LLO 26.3 Draw and lable 3 core D.C. Cable LLO 26.4 Draw and lable Drill cable	26	Different types of Types of Flexible cable (Cross Section)	2	CO5
LLO 27.1 Assemble Different parts of the cable joint box LLO 27.2 Draw and Label different parts of the cable joint box	27	Preparation of Cable joint box.	2	CO5
LLO 28.1 Identify the different type of screening from given Cable Samples. LLO 28.2 Draw and label cable with Collective Screening LLO 28.3 Draw and label cable with Individually Screened	28	Different types Screening of cable	2	CO5
LLO 29.1 Draw and Explain the Pilot Circuit in Gate End Box. LLO 29.2 Identify the different parts and circuits used for pilot protection	29	Safety in using Pilot Circuit in Gate End Box.	2	CO5
LLO 30.1 Explain how Gate End Box is Flame proof Devicele. Identify the Flame proof Devicele from list LLO 30.2 Define Intrinsically safe Device . Identify the Intrinsically Devicele from list	30	Flame proof Device and Intrinsically safe Device used in underground mines.	2	CO5

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
Note : Out of above suggestive LLOs - • '*' Marked Practicals (LLOs) Are mandatory. • Minimum 80% of above list of lab experiment are to be performed. • Judicial mix of LLOs are to be performed to achieve desired outcomes.				

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- a. Transportation in Underground Mines: Visit any underground coal mine and prepare the complete report of various transportation systems used in that mine. And Present it. Collect or prepare the Video of any one topic of the above topics and present it before the class. b. Winding in Shafts: Visit any underground mine where the shaft winding is exist and prepare the complete report of winding systems used in that mine. And Present it. Collect or prepare the Video of any one topic of the above topics and present it before the class. c. Steel Wire Ropes Used in Underground Mines: Collect actual field data for actual type of wire rope used in rope haulage, winding, and machineries. Collect or prepare the Video of any one topic of the above topics and present it before the class. d. Pumps used in Underground Mines: prepare the cut out Model of Different types of Pumps used in Mines. Collect or prepare the Video of any one topic of the above topics and present it before the class. e. Underground Power Cables and Gate End Box: Prepare the charts of different cross section of power Cables used in underground Mines. Identify and prepare the circuits for different Safety devices used in Gate End Box. Collect or prepare the Video of any one topic of the above topics and present it before the class.

Assignment

- Collect the data and prepare the report on range of mine trucks for underground mining and tunneling applications includes models with payload capacities from 20-65 tonnes. The articulated underground trucks have a high power-to-weight ratio for good speed on steep grades. The computerized drive system, Rig Control System, RCS, provides service information and diagnostics that are logged as well as displayed on the screen inside the cab. It is a powerhouse designed for fast, productive haulage in substantial mining and construction operations where navigation through narrower tunnels is required. The build in reliability combined with higher capacity and high ramp speed leads to dramatically increased productivity. Operators work in comfort with optional air conditioning and ergonomic controls, boosting productivity and reducing fatigue.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

MINE MACHINERY**Course Code : 333305**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Model / Video clip of the different types of Haulages a) Single Drum Haulage b) Double Drum Haulage c) Under rope Haulage d) Over rope Haulage e) Main and Tail rope Haulage f) Gravity rope Haulage g) Model showing different types of tensioning arrangements , different types of driving pulleys, different types of rope attachments with tubs	1,2,3,4
2	Model / video clip showing Different types of Drum Winding 1 Cylindrical drum 2 Conical drum 3 Cyliandroconical drum 4 Bicydroconical drum	10
3	Model / Chart / video clip showing different Provisions on winding drum 1 Depth indicator 2 Mechanical Brakes (different types) 3 Automatic Contrivance 4 Angle of fleet	11
4	Model / video clip of Cage suspension Gear showing 1 Rope Carpel 2 D link and bull chain 3 Safety hook 4 Triangular distribution plate 5 Bridle chain	12
5	Model / video clip of Different types of keps 1 Rigid keps 2 Davies improved keps gear.	13
6	Model / Chart / video clip showing Different types of Koepe Winding 1 Ground mounted Koepe System 2 Tower mounted Koepe System	14
7	Samples of Different types of Stranded rope and Non Stranded rope1 Round Stranded Rope2 Triangular Strand Rope or Flattened Strand Rope3 Multi-Strand Rope4 Flat Rope5 Locked Coil Rope or Full Locked Coil Rope6 Half Locked Coil Rope7 Guide ropes	15,16
8	Samples of different types of Cores and Lays of wire rope Different types of Cores 1 Fiber core , 2 wire rope core , 3 IWRC Different types of Lays of rope 1 Right hand lay 2 left hand lay 3 Langs lay 4 ordinary lay 5 alternate lay	17
9	Model / Sample / video clip showing different types of Rope Capping 1 White metal capping (cone socket type capel) 2 Wedge type capping (Reliance rope capel) 3 Capping with split capel and rivets (Split capel)	18
10	Set of different tools used in Rope splicing procedure and / video clip showing operation of rope splicing	19
11	Models / Cut outs / video clip of Different Types of Reciprocating Pumps 1 Single acting 2 Double acting 3 Three throw Ram pumps	20
12	Models/ Cut outs / video clip of Different Types of Centrifugal Pump 1 Volute Pump 2 Turbine Pumps	21
13	Model/ Chart / Cut Out / video clip showing Fitting on pump, foot valve, suction valve, delivery valve, retaining valve, air vessels, and air cock. Pressure gauge.	22
14	Model/ Chart / Cut Out / video clip showing following Types of face Pump1 Roto Pump2 Drill Operated portable pump	23
15	Samples of different types of Types of Permanent cable / Semi flexible cable / Flexible cable	24,25,26
16	Model/ Chart / Cut Out showing Cable joint box. video clip showing operation of Cable Joint Box	27
17	Samples of cable showing types Screening of cable1) Collective Screening2) Individually Screened	28
18	Chart showing Pilot Circuit in Gate End Box. Video Clip / animations showing different safety devices of Gate End Box and there working.	29
19	Sample of equipment showing any one type of Flame proof Device and One Type of Intrinsically safe Device	30
20	Model / Video of different types of Safety devices used on rope haulage system 1 Stop block/Buffers 2 Back stay 3 Monkey catch 4 Age craft Device 5 Runaway Switch 6 Drop Warwick 7 Jazz Rails 8 Retarders 9 Pointer Plate	5
21	Chart showing Section of Exhaust Conditioner and flame trap of Diesel locomotive	6
22	Chart / video clip showing Different parts of Scraper Chain conveyor	7

MINE MACHINERY**Course Code : 333305**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
23	Model / video clip showing a) arrangement of belt conveyor b) layout of face ,gate and trunk conveyor in coal mine	8
24	Model /video clip showing 1 Head gear 2 Headgear pulley 3 Cage/Skip 4 Winding drum 5 Guides 6 Keps 7 Suspension Gear	9

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Transportation of men and material in Underground Mines	CO1	20	3	6	6	15
2	II	Winding in Shafts	CO2	20	3	6	6	15
3	III	Steel Wire Ropes Used in Underground Mines	CO3	14	2	6	4	12
4	IV	Pumps used in Underground Mines	CO4	16	4	6	4	14
5	V	Underground Power Cables and Gate End Box	CO5	20	4	6	4	14
Grand Total				90	16	30	24	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Mid Term Online Tests Rubrics for COs Assignment,Self Learning and Term WorkSeminar/Presentation

Summative Assessment (Assessment of Learning)

- End of Term Examination Viva-voce Lab Performance

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	1	2	1	1	2			
CO2	3	2	2	2	1	1	2			
CO3	3	2	2	2	2	1	2			
CO4	3	2	2	2	2	1	2			

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CO5	3	2	1	2	1	2	2			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Heartman L. Howard	Introductory Mining Engineering	John Wiley & Sons, New York, ISBN: 0-471-62804-2
2	S. Ghatak	Mine Pumps , Haulage and Winding	Coal Field Publishers , Skylark, J.C.BOSE lane Asansol- 713302
3	M. K. Bhattacharyya	Mining Machinery	Geeta Book Stores , Dhanbad
4	Deshmukh, D.J.	Elements of Mining Technology (Mining Machinery) Volume III	Lovely Prakashan, Dhanbad ISBN-13:978-8189904357

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=5UK6f9q3-0s	You Tube Mining Machinery videos
2	https://www.slideshare.net/bestmadeinkorea/mining-machinery-71084309?from_search=2	Slide Share Mining Machinery Material
3	https://www.dgms.net/downloads.html	DGMS Download Link

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 02/07/2024**Semester - 3, K Scheme**

WINNING AND WORKING - NON COAL**Course Code : 333306****Programme Name/s : Mining & Mine Surveying/ Mining Engineering****Programme Code : MS/ MZ****Year : Third****Course Title : WINNING AND WORKING - NON COAL****Course Code : 333306****I. RATIONALE**

After obtaining Diploma in Mining and Mine Surveying many of the students join the metaliferrous mines as foreman. They are required to supervise operations involved in underground metal mines. Also shaft sinking is the unique feature of the mining process and Diploma holder need to supervise the entire process of shaft sinking. The knowledge of underground metal mining, shaft sinking and boring is essential for the student.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competencies through various teaching learning experiences:

Select suitable method of stoping for underground metal mining and undertake shaft sinking operations and know about drilling operations.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Supervise development and stoping operations in underground metaliferrous mines.
- CO2 - Select the appropriate unsupported stoping method as per field conditions.
- CO3 - Select the appropriate supported stoping method as per field conditions.
- CO4 - Select the appropriate process of shaft sinking.
- CO5 - Supervise the boring operation on the site of Boring/Drilling.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme													Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL				
				CL	TL	LL					Practical				Based on SL								
											FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA				
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
333306	WINNING AND WORKING - NON COAL	WNC	DSC	3	-	2	-	5	5	3	30	70	100	40	25	10	25#	10	-	-	150		

Total IKS Hrs for Sem. : Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Illustrate the given terms used in metalliferous mining. TLO 1.2 Explain different different factors for deciding level interval. TLO 1.3 Explain different methods of raise and winze driveage	Unit - I Underground development 1.1 Terminology used in metal mines. 1.2 Level interval, factor considered while deciding level interval/length of back. 1.3 Driveage of raises and winzes, Driving manually, Modern methods Alimak, long hole method, Drop raising, raise boring.	Lecture Using Chalk-Board Video Demonstrations Presentations Site/Industry Visit
2	TLO 2.1 Classify the various stoping methods. TLO 2.2 Select the appropriate unsupported stoping method for the given conditions.	Unit - II Unsupported stoping method's 2.1 Underground Stoping Method and their classification, choice of stoping methods. underhand, overhand, Breast stoping 2.2 Open stoping methods, Sublevel stoping, Sublevel stoping with backfilling/pastefilling, Blast hole stoping, VCR , Shrinkage method, their conditions of Applicability, Sequence of Development, Stopping operation, Cycle of operations etc. System of removal of ore from stope.	Lecture Using Chalk-Board Video Demonstrations Case Study Presentations Flipped Classroom
3	TLO 3.1 Select the appropriate supported stoping method for the given conditions. TLO 3.2 Select the appropriate caving method for the given conditions	Unit - III Supported and caving methods 3.1 Artificially supported methods cut and fill, Their applicability, stope Preparation, stoping operation, cycle of operation, relative merits and demerits etc. 3.2 Caving methods - Sublevel caving and block caving methods, applicability, stope preparation stoping, cycle of operation etc.	Lecture Using Chalk-Board Video Demonstrations Presentations Case Study Hands-on

WINNING AND WORKING - NON COAL**Course Code : 333306**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Select the site for shaft sinking under given conditions. TLO 4.2 Describe the given operations involved in sinking of a shaft. TLO 4.3 Describe the given lining methods of shaft sinking. TLO 4.4 Describe the given special methods of shaft sinking.	Unit - IV Access to deep seated metal deposits 4.1 Preliminary about shaft sinking, Size, shape, Factors considered for location of shaft, marking center, and shaft-centering arrangement. 4.2 Ordinary sinking up to rock head, sinking of shaft below rock head- operation of drilling, charging and blasting and mucking operation. Disposal of debris. 4.3 Shaft lining: Temporary lining, Permanent lining of shaft: Brick, monolithic, reinforced concrete lining, shaft tubing's etc. Walling scaffold, rider, water garland crib etc. 4.4 Different special methods of shaft sinking, condition of applicability of each method, Description etc. Widening and Deepening of shaft.	Video Demonstrations Case Study Presentations Model Demonstration Lecture Using Chalk-Board
5	TLO 5.1 Classify the various methods of boring / drilling. TLO 5.2 Identify the given types of drill bits used in drilling. TLO 5.3 Describe the given core barrel. TLO 5.4 Describe the given methods of borehole deviation.	Unit - V Rock penetration techniques 5.1 Purpose of boring, classification of boring methods, applicability of boring methods. 5.2 Drill Bits for various types of drilling/boring. 5.3 Core recovery, core barrels, Recover of broken tools, bits. 5.4 Bore hole survey, Deviation of boreholes.	Model Demonstration Lecture Using Chalk-Board Flipped Classroom Video Demonstrations Collaborative learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Draw a sketch of metaliferous mine and Interpret terminology used in metal mines.	1	terminology used in metal mines.	4	CO1
LLO 2.1 Draw a layout of sublevel stoping method and Interpret the method.	2	Interpret sublevel stoping method	4	CO2
LLO 3.1 Draw a layout of Shrinkage stoping method and Interpret the method.	3	Interpret Shrinkage stoping method	4	CO2
LLO 4.1 Draw a layout of Cut & fill method and Interpret the method.	4	Interpret Cut & fill method	4	CO3
LLO 5.1 Draw a layout of Sublevel caving method and Interpret the method.	5	Interpret Sublevel caving method	4	CO3
LLO 6.1 Draw temporary lining in sinking shaft and Shaft tubbings and Interpret it.	6	Interpret temporary lining in sinking shaft and Shaft tubbings .	4	CO4
LLO 7.1 Draw the arrangement for marking the centre of shaft and maintaining verticality of sinking shaft and Interpret it.	7	Interpret the arrangement for marking the centre of shaft and maintaining verticality of sinking shaft	4	CO4
LLO 8.1 Draw the arrangement for sinking rider used during sinking and Interpret it.	8	Interpret the arrangement for sinking rider used during sinking	4	CO4

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 9.1 Draw the arrangement for drilling blasting and removal of debris of sinking shaft and Interpret it.	9	Interpret the arrangement for drilling blasting and removal of debris of sinking shaft	4	CO4
LLO 10.1 Draw the arrangement for bricking scaffold and Interpret it.	10	Interpret the arrangement for bricking scaffold.	4	CO4
LLO 11.1 Draw the arrangement for different types of permanent lining and Interpret it.	11	Interpret the arrangement for different types of permanent lining.	4	CO4
LLO 12.1 Draw the arrangement for Piling and Forced drop shaft method of shaft sinking and Interpret it.	12	Interpret the arrangement for Piling and Forced drop shaft method of shaft sinking.	4	CO4
LLO 13.1 Draw the arrangement for Cementation and Freezing method of shaft sinking and Interpret it.	13	Interpret the arrangement for Cementation and Freezing method of shaft sinking	4	CO4
LLO 14.1 Draw the arrangement for Widening and Deepening of a shaft and Interpret it.	14	Interpret the arrangement for Widening and Deepening of a shaft	4	CO4
LLO 15.1 Identify different types of drill bits used in boring, Draw its sketches	15	Types of drill bits used in boring.	4	CO5
LLO 16.1 Identify various parts of single tube and double tube core barrel used in boring, Draw its sketches.	16	Parts of single tube and double tube core barrel.	4	CO5
Note : Out of above suggestive LLOs - • '*' Marked Practicals (LLOs) Are mandatory. • Minimum 80% of above list of lab experiment are to be performed. • Judicial mix of LLOs are to be performed to achieve desired outcomes.				

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Visit a nearby metalliferous mine and collect the relevant information on stoping method used in a mine.
- Visit a nearby metalliferous mine and collect the relevant information on different transportation machineries and layout in a metal mine.
- Visit a nearby metalliferous mine and collect the relevant information on type of shaft, shaft lining and procedure followed in making the shaft in a nearby metalliferous mine.
- Visit a nearby metalliferous mine and collect the relevant information on drilling machine & different bits used in a nearby mine.
- Visit a nearby metalliferous mine and collect the relevant information w.r.t. cross cut, orechute, orebin, ladders, raises and winzes.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Model of a metalliferous mine	1
2	Drill bits- diamond drill bit, tricone drill bit	15
3	Model of Sublevel stoping	2
4	Model of Shrinkage stoping	3
5	Model of Cut & fill stoping	4
6	Model of Sublevel caving	5

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Underground development	CO1	16	2	4	4	10
2	II	Unsupported stoping method's	CO2	18	2	8	6	16
3	III	Supported and caving methods	CO3	20	2	8	6	16
4	IV	Access to deep seated metal deposits	CO4	20	2	8	6	16
5	V	Rock penetration techniques	CO5	16	2	4	6	12
Grand Total				90	10	32	28	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Progressive test 1
- Progressive test 2
- Lab performance
- Journal submission

Summative Assessment (Assessment of Learning)

- Viva-voce
- End year exam

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3		1	2		3				
CO2	3		2	3		3	2			
CO3	3		2		2	3	2			
CO4	3	1	2	2	1	3	2			
CO5	3		1	2	3	3	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
 *PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	D. J. Deshmukh	Elements of Mining Technology Vol. I & II	Dennet, Nagpur ISBN: 978-81-89904-34-0
2	Heartman L. Howard	Introductory Mining Engineering	John Wiley & Sons, New York ISBN: 0-471-62804-2
3	S. Ghatak	Winning & Working	Coalfield Publishers, Asansol.

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/uIXgJ0giY8o?si=R1QSa93hqooEWvUO	Terminology used in Underground Metal Mines
2	https://youtu.be/J7znncujO4g?si=1dM4TUE1iLbija_V	Modern method of raising Alimak raise climber Long hole raising Drop raising method
3	https://youtu.be/0WaycemfFfY?si=FEQeKk8E8Zk1Ull-	Underhand Stopping Method in metal mines
4	https://youtu.be/Y1axQEY1PDQ?si=rk0ZN54Sxb6NwvK0	Overhand stoping method in metal mining
5	https://youtu.be/BdU6-DvnpVU?si=jnytPHktejYs2y2	Sublevel stoping mining method
6	https://youtu.be/M9A_Gybcf3U?si=YVep0CqarxvLPQYu	Cut and fill mining method
7	https://youtu.be/ZmKwdtFkoxo?si=GoSCcWkQxtnOjMrv	Sublevel caving mining method
8	https://youtu.be/MWqMD85MVO4?si=awGVXCniYcm4SDTK	Block caving mining method

WINNING AND WORKING - NON COAL**Course Code : 333306**

Sr.No	Link / Portal	Description
9	https://youtu.be/MMqdLV4gDj4?si=agCD0bfuc87LPzFn	Temporary Lining of shaft
10	https://youtu.be/yKx9H_hgad8?si=_QDKotoUmpyKVik-	Permanent lining of shaft
11	https://youtu.be/uT0nq5RE74k?si=ZZN_TnuA8K9g5edJ	Special methods of shaft sinking
12	https://youtu.be/Kar33L5lQv4?si=Y8YjKTUW_Dbl2bYP	Percussive drilling and it's types
13	https://youtu.be/u_x6uN5G0os?si=mdae4ntCXvh0vdN2	Rotary Drilling concepts
14	https://youtu.be/47eM56Gj1qg?si=R0IfAOcNnSRW8IY1	Borehole deviation complete
Note : Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students		

MSBTE Approval Dt. 02/07/2024**Semester - 3, K Scheme**

MINE AND MINERAL ECONOMICS**Course Code : 333309****Programme Name/s : Mining & Mine Surveying/ Mining Engineering****Programme Code : MS/ MZ****Year : Third****Course Title : MINE AND MINERAL ECONOMICS****Course Code : 333309****I. RATIONALE**

Basic knowledge of Mine and Mineral Economics is essential for diploma engineers to execute the job in most productive manner. Before entering into the industry pass out should be aware about the National Mineral Policy, Mineral based Industries of the country and their role in National Economy, knowledge of Computation & classification of mineral reserves, sampling techniques and grade determination. Students should be able to understand modern methods of mineral property evaluation & calculation of depreciation. Information about ore dressing methods for mine products is also included in the course, so that Mining Diploma Engineers can perform the job efficiently by using the knowledge and skills of this course.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: • Apply Basic Knowledge of Mine Economics to Perform Mining Operations Efficiently.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Comprehend the Role of Mining Industry in the National Economy.
- CO2 - Carryout the Computation & Classification of Reserves and Grade estimation.
- CO3 - Use Methods of Sampling for Different types of Ore Deposits.
- CO4 - Calculate the Value of Mineral Properties on Cash Flow Analysis and Estimate the Depreciation.
- CO5 - Use Suitable Ore Dressing Methods for the Mine Products.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week	SLH		NLH	Paper Duration		Theory				Based on LL & TL				Based on SL		Total Marks	
														Practical							
										CL	TL	LL	FA-TH	SA-TH	Total		FA-PR				SA-PR
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min												
333309	MINE AND MINERAL ECONOMICS	MEC	DSE	2	-	-	1	3	3	3	30	70	100	40	-	-	-	-	50	20	150

Total IKS Hrs for Sem. : 1 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain Role of Mineral Industries in National Economy. TLO 1.2 Describe Five Mineral based industry in India. TLO 1.3 State the highlights of National Mineral Policy TLO 1.4 Describe the measures taken for conservation of Minerals.	Unit - I Importance of the Indian mineral industry 1.1 Mineral Industry & National Economy-Basic Economic System ,Contribution of mining Industries in national economy.,Self-reliance of the country in respect of core sector minerals. 1.2 Basic mineral based industry in India.-Iron and Steel, Copper Smelting, Aluminium, Lead & Zinc Smelting & Cement Industries, their description, location, capacity, main producers. 1.3 Highlights of Latest National Mineral Policy . 1.4 Importance of mineral Conservation. & Its Measures. * Ancient Indian Mineral Economics (IKS)	Presentations Lecture Using Chalk-Board Video Demonstrations
2	TLO 2.1 Classify the resources based on geological study and Classify the reserves based on feasibility study. TLO 2.2 Describe given types of grades. of ores . TLO 2.3 Calculate grade and tonnage of ore block using given methods and parameters.	Unit - II Mineral Reserves 2.1 United Nations Framework Classification (UNFC)- Distinct resource and reserve categorization under UNFC based on geological and feasibility study. 2.2 Classification of Grades -Definitions of tenor and grade, Computed grade, Effective or Mining grade, Run of Mine grade, Mill head grade, economical grade, cut off grades and minimum mining grade, factors influencing the Cut-off Grade, 2.3 Basics of computation of mineral reserves - Rule of Area of influence method , Gradual change method ,Geometric and graphical methods for computation of tonnage and grade of resources in mining ,Weighted average grade estimation .	Presentations Lecture Using Chalk-Board Video Demonstrations

MINE AND MINERAL ECONOMICS**Course Code : 333309**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain methods of sampling . TLO 3.2 Explain Criteria for Selection of Sampling Procedure. TLO 3.3 Explain Methods of Sample Preparation	Unit - III Methods of sampling 3.1 Principles of sampling - Types of sampling methods, Stratified Sampling, Pattern Sampling, Systematic Sampling & Random sampling, their description . 3.2 Methods of sampling based on manner , shape and type of mineralization and place of sample collection like Grab sampling, Chip sampling, Channel or groove sampling, Wagon or car sampling, Placer Sampling, Dump Sampling, Blast hole sampling, Bulk sampling, Borehole sampling etc. Errors in sampling, and Safe procedures for collecting samples. 3.3 Preparation of sample- preparation or reduction of sample, Richards Chichette formula, Coning and Quartering, and Splitting	Presentations Lecture Using Chalk-Board Video Demonstrations
4	TLO 4.1 Explain the Modern Method of Mine Property Valuation. TLO 4.2 Explain Steps for Mine Property Valuation TLO 4.3 Calculate Depreciation using given Method	Unit - IV Valuation of Mining Property 4.1 Valuation of mining property - Mine valuation concept & Purpose , Discounted Cash Flow Methods e.g. Net Present Value, Internal Rate of Return . 4.2 Steps for valuation and cost estimation - Factors considered in mine valuations, Risk Factors associated with Mine valuation. 4.3 Depreciation- Concept of depreciation, its importance and causes , Calculation of Depreciation using: Straight line method and Reducing balance method	Presentations Lecture Using Chalk-Board Case Study
5	TLO 5.1 Explain the steps involved in ore beneficiation. TLO 5.2 Explain Different Methods of ore dressing. TLO 5.3 Explain Agglomeration process	Unit - V Ore Dressing Methods 5.1 Importance of Ore dressing - Advantages and importance of mineral beneficiation, Steps involved in mineral beneficiation: liberation and separation. 5.2 Methods of ore dressing -Crushing, and grinding , Gravity Separation: Tabling, Jigging Heavy Media separation. , Magnetic separation, Electrostatic Separation froth flotation etc 5.3 Agglomeration processes -Sintering, and Palletising and their description	Presentations Lecture Using Chalk-Board Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.**VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)****Micro project**

- 1 Mineral based industry: Collect recent data from websites on economic parameters of India, and identify the factors / components for comparison of role of mineral industry in national economy. Prepare presentation on important provisions of MMDR Amendment Act, 2015 along-with brief report on provisions regarding District Mineral Foundation & National Mineral Exploration Trust."
- 2 Prepare comparative analysis on different systems of classification of Reserves with UNFC adopted in India.

MINE AND MINERAL ECONOMICS**Course Code : 333309**

- 3 Prepare PowerPoint presentation on Mining Plan for MCDR minerals, provisions for grant of mining leases through auction in respect major minerals. Final Mine closure plan.
- 4 Ore dressing: Visit ore dressing lab and plants in the nearby mining areas and get abreast with various methods of Mineral Beneficiation.
- 5 Mine valuation and Depreciation- prepare a report on concept of cash flow, NPV, IRR and Depreciation of any mine you have visited

Assignment

- National mineral policy 2019
- UNFC classification of Mineral Reserves
- Various Methods of Sampling
- Modern Method of Mine Property Valuation
- Importance of Ore Dressing

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	No laboratory equipment as it is a theory subject	All
2	No laboratory equipment as it is a theory subject	All
3	No laboratory equipment as it is a theory subject	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Importance of the Indian mineral industry	CO1	10	2	4	6	12
2	II	Mineral Reserves	CO2	14	2	4	10	16
3	III	Methods of sampling	CO3	13	2	4	10	16
4	IV	Valuation of Mining Property	CO4	13	2	4	10	16
5	V	Ore Dressing Methods	CO5	10	2	4	4	10
Grand Total				60	10	20	40	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

MINE AND MINERAL ECONOMICS**Course Code : 333309**

- Mid Term Tests Rubrics for COs Assignment, Self-learning and Term Work Seminar/ Presentation

Summative Assessment (Assessment of Learning)

- End of Term Examination, Viva-voce, Micro project seminars

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	-	-	-	-	1			
CO2	3	2	1	-	1	2	2			
CO3	3	3	2	-	1	1	1			
CO4	3	2	2	-	1	1	2			
CO5	3	2	3	1	1	2	1			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	N INDRA, AND SUBHASH RAY	Mine and Mineral Economics	ISBN NO 9788120351745, PHI Learning Pvt. Ltd, Rimjhim House, 111, Patparganj Industrial Area, Patparganj, New Delhi, Delhi, 110092 ISBN NO 9788120351745 Edition year 2017
2	F.J.ANDERSON	Selected readings in Mineral Economics	LACKHEAD UNIVERSITY, 955 Oliver Rd, Thunder Bay, ON P7B 5E1, Canada ISBN 9781483160627 Edition year 2019
3	R.K.SINHA AND SHARMA	Mineral economics	CBS PUBLISHERS, No 4819/11, CBS Plaza, Ansari Road, Prahlad Street 24, Darya Ganj, Delhi - 110002 (Near Sanjeevan Hospital) ISBN 97881201403314 edition year 2017
4	AROGYASWAMI R N P	Courses in Mining Geology	OXFORD & IBH PUBLISHING CO PVT. LTD, Office No. 12, Ground Floor, Jolly Bhavan No.1, 10, Vitthaladas Thackersey Marg, behind Syndicate Bank, New Marine Lines, Churchgate, Mumbai, Maharashtra 400020 ,ISBN: 9788120409378, 9788120409378 Edition -4 year 2019
5	AROGYASWAMI R N P	Courses in Mining Geology	OXFORD & IBH PUBLISHING CO PVT. LTD, Office No. 12, Ground Floor, Jolly Bhavan No.1, 10, Vitthaladas Thackersey Marg, behind Syndicate Bank, New Marine Lines, Churchgate, Mumbai, Maharashtra 400020 ,ISBN: 9788120409378, 9788120409378 Edition -4 year 2019

MINE AND MINERAL ECONOMICS**Course Code : 333309**

Sr.No	Author	Title	Publisher with ISBN Number
6	A.M. GAUDIN	Principals of Mineral Dressing	Mcgraw Hill Education india Pvt Ltd in Banashankari 3rd Stage, Bangalore ISBN NO-978-0070230309 13 TH Edition.
7	Samuel Jhon Trusscott	A TEXT BOOK OF MINERAL DRESSING	Nabu Press Charleston, South Carolina, ISBN- 9781149569887, EDITION 13

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=hmgR4PiGp1E	MINE ECONOMICS
2	https://www.youtube.com/watch?v=lZnJ4iyBKN8	SAMPLING SALTING AND PREPARATION OF SAMPLES
3	https://www.ibm.govt.in	INDIAN MINING INDUSRTY
4	https://www.mineeconomicsshop.com	MINE ECONOMICS
5	https://www.msbte.com	E-CONTENT ON MINE ECONOMICS
6	https://mines.govt.in	MCDR ACT, MMDR ACT
7	https://econbus.mines.edu/mineral-energy-economics/	MINE AND MINERAL ECONOMICS
8	https://https://www.ltu.se/en/research/research-subjects/economics/mineral-economics	MINE AND MINERAL ECONOMICS

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 02/07/2024**Semester - 3, K Scheme**

ENTREPRENEURSHIP AND STARTUPS IN MINING**Course Code : 333001**

Programme Name/s : Mining & Mine Surveying/ Mining Engineering
Programme Code : MS/ MZ
Year : Third
Course Title : ENTREPRENEURSHIP AND STARTUPS IN MINING
Course Code : 333001

I. RATIONALE

Revolution in information technology have opened up new opportunities transforming lives of masses due to globalization, liberalization and privatization. In this context, there is immense opportunity of establishing manufacturing, service, trading, marketing and consultancy enterprises by diploma engineer. Rapid growing economy provides ample scope for diploma engineers to succeed as an entrepreneur. Entrepreneurship requires distinct skill sets which are attempted to be developed through this course. In this course aim is to design and develop the competency and related outcomes in order to start small enterprises in the area of mining industry.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop proposal for launching small scale industry related to mining.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify features of Entrepreneurship .
- CO2 - Select proper business opportunities.
- CO3 - Calculate breakeven point, return on investment and sale for given application.
- CO4 - Prepare comprehensive business plans.
- CO5 - Identify risk to manage the enterprise effectively.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL			Total Marks
															Practical				SLA			
				CL	TL	LL	FA-TH	SA-TH			Total		FA-PR		SA-PR		SLA					
																			Max	Max	Max	
333001	ENTREPRENEURSHIP AND STARTUPS IN MINING	EDM	AEC	-	-	1	1	2	2	-	-	-	-	-	50	20	25@	10	25	10	100	

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Evaluate features of Entrepreneurship for given application in the area of mining. TLO 1.2 Justify the scope of Entrepreneurship in local and global market. TLO 1.3 Distinguish between Intrapreneur and Entrepreneur. TLO 1.4 Compare Entrepreneurship features on the basis of given points.	Unit - I Entrepreneurship Development 1.1 Introduction to Entrepreneurship and Features of successful intrapreneur/ entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking. 1.2 Entrepreneurship : scope in local and global market in the area of mining. 1.3 Intrapreneur and Entrepreneur for mining applicaiton. 1.4 Types of enterprises and their features : manufacturing, service and trading, Steps in setting up of a business (related to mining).	
2	TLO 2.1 Select proper product/service for given mining application. TLO 2.2 Justify the factors affecting location of mining industry. TLO 2.3 Select proper method for data collection for setting of new mining industry. TLO 2.4 Compare various government procedure for the development of mining industry.	Unit - II Entrepreneurship Opportunities and selection process 2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development. 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Instries Commission[KVIC]	

ENTREPRENEURSHIP AND STARTUPS IN MINING**Course Code : 333001**

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Justify the use of support system for the Establishment of any mining industry. TLO 3.2 Collect the support provided by various government agencies. TLO 3.3 Compare different support from government agencies for various support required for development of mining industry. TLO 3.4 Calculate breakeven point for given application in the area of mining industry.	Unit - III Support Systems 3.1 Categorisation of MSME, ancillary industries. 3.2 Support systems- government agencies: MCED, NI-MSME, PMEGP, DI, KVIC. 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance. 3.4 Breakeven point, return on investment and return on sales.	
4	TLO 4.1 Prepare budget plan for given application related to mining industry. TLO 4.2 Prepare business plan for given application for mining industry.	Unit - IV Business Plan 4.1 Sources of Product for Business : Feasibility study, 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project , feasibility report preparation and evaluation criteria 4.2 Business plan preparation	
5	TLO 5.1 Justify USP on the basic of identification and development for the purpose of mining industry. TLO 5.2 Generate a business policies for given applications of mining industry. TLO 5.3 Identify the risk for given application related to mining industry. TLO 5.4 Justify the role of incubation centres for managing mining industry.	Unit - V Managing Enterprise 5.1 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan. 5.2 Preparing strategies of handling business: policy making, negotiation and bargaining techniques. 5.3 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, angel investors, venture capitalist. 5.4 Incubation centres: Role and procedure.	

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
	1	Perform SWOT analysis for given application.	2	CO1
	2	Perform self-assessment test to discover your entrepreneurial features.	2	CO2
	3	Identify the business opportunities for given application.	2	CO2
	4	Plan business ideas(product/service) for intrapreneurial and entrepreneurial opportunities through brainstorming.	2	CO2
	5	Perform market survey using Market study procedures for given application.	2	CO2

ENTREPRENEURSHIP AND STARTUPS IN MINING**Course Code : 333001**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
	6	Collect information about various funding schemes available for small scale enterprise by visiting a bank/financial institution.	2	CO3
	7	Collect information about loan procedure for small scale industries from nationalized banks.	2	CO3
	8	Prepare financial feasibility report of a given application.	2	CO3
	9	Prepare a plan of short term, medium and long term goals for starting a given small scale industry.	2	CO3
	10	Prepare Technological feasibility report for a given application.	2	CO3
	11	Calculate breakeven point for given application.	2	CO3
	12	Calculate breakeven point for given application.	2	CO3
	13	Calculate breakeven point for given application.	2	CO3
	14	Calculate return on investment for given application.	2	CO3
	15	Calculate return on investment for given application.	2	CO3
	16	Calculate return on investment for given application.	2	CO3
	17	Calculate return on sale for given application.	2	CO3
	18	Calculate return on sale for given application.	2	CO3
	19	Calculate return on sale for given application.	2	CO3
	20	Perform feasibility study for preparation of given business plan/application.	2	CO4
	21	Perform feasibility study for preparation of given business plan/application.	2	CO4
	22	Prepare detailed budget plan for given application.	2	CO4
	23	Prepare detailed budget plan for given application.	2	CO4
	24	Prepare marketing strategy for your given application.	2	CO4
	25	Prepare report on evaluation criteria for given application.	2	CO4
	26	Prepare Craft a vision statement for given application.	2	CO3
	27	Arrange event Entrepreneurship development in your class and write a report on it.	2	CO5
	28	Prepare a business plan for given application.	2	CO5
	29	Arrange a expert lecture and discussion session on entrepreneurship.	2	CO5
	30	Prepare a power point presentation and present it in the class on given topic.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)**Micro project**

- Develop website for given application.

- Prepare advertisement for given application.

Assignment

- Arrange brainstorming sessions for improvement of any product of given application.
- Bring sponsorship from the market for arranging fairs, events or exhibition in the institute.
- Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
- Perform SWOT analysis of yourself.
- Arrange exhibition for marketing of products in the class.
- Perform geographical survey to identify local resources available for setting up new business in your area.
- Perform demand and supply gap analysis for a given application.

Invite entrepreneurs, industry officials, bankers for interaction.

- Invite entrepreneurs, industry officials, bankers for interaction.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Seminar Hall equipped with conference table, chairs and multimedia facilities.	All
2	Modern desktop Computer with internet connection.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE**X. ASSESSMENT METHODOLOGIES/TOOLS****Formative assessment (Assessment for Learning)**

- 50

Summative Assessment (Assessment of Learning)

- 25@

XI. SUGGESTED COS - POS MATRIX FORM

ENTREPRENEURSHIP AND STARTUPS IN MINING**Course Code : 333001**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3						3			
CO2	3	3	3				3			
CO3	3	3	3				3			
CO4	3	3	3				3			
CO5	3	3	3				3			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Mehta, Monica	The Entrepreneurial Instinct : How Everyone Has the Innate Ability to Start a Successful Small Business	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Hisrich, R. D.	Entrepreneurship	McGraw-Hill Education, New Delhi, 2013 ISBN-13: 978-1259001635
3	CPSC, Manila	Entrepreneurship Development: Special edition for MSBTE	Tata Mc-Graw Hill, New Delhi,
4	Khanka, S.S.	Entrepreneurship and Small Business Management	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6
5	S, Anil Kumar	Entrepreneurship Development	New Age International, New Delhi, ISBN: 9788122414349
6	Dr. Nishith Dubey, Aditya Vyas , Annu Soman , Anupam Singh	Un- boxing Entrepreneurship your self help guide to setup a successful business	Indira Publishing House ISBN2023,978-93-93577-70-2
7	Gujral, Raman	Reading Material of Entrepreneurship Awareness Camp	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad
8	Charantimath, Poornima	Entrepreneurship Development Small Business Entrepreneurship	Pearson Education India, New Delhi; ISBN: 9788131762264

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=SX4_9YNHm9g	Startup
2	https://www.youtube.com/watch?v=Xcsp0486oIY	entrepreneurship
3	https://www.youtube.com/watch?v=UEngvxZ11sw	entrepreneurship
4	https://www.youtube.com/watch?v=gpv6X6E3Qxw	entrepreneurship
5	https://www.youtube.com/watch?v=CBYhVcO4WgI	Startup

ENTREPRENEURSHIP AND STARTUPS IN MINING**Course Code : 333001**

Sr.No	Link / Portal	Description
6	https://www.youtube.com/watch?v=BUE-icVYRFU	Startup
7	https://www.youtube.com/watch?v=D7cF12-R18w	Startup

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 02/07/2024**Semester - 3, K Scheme**

INDUSTRIAL TRAINING / PROJECT 2**Course Code : 333002****Programme Name/s : Mining & Mine Surveying/ Mining Engineering****Programme Code : MS/ MZ****Year : Third****Course Title : INDUSTRIAL TRAINING / PROJECT 2****Course Code : 333002****I. RATIONALE**

I. RATIONALE The aim of the diploma education in Mining is to create a pool of skill based manpower to supervise the various operations in Underground and Opencast working. Industrial training in mining has been the integral part of curriculum of Mining. Industrial training shall be completed in summer vacation of Second year and students are free to choose the training in Underground Mines or Opencast Mines. The provision is also made for Study project instead of Training for those students who are below 18 years and could not get the required permission from DGMS office to undergo training.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop the skills of mining and applying theoretical knowledge to the practical field experience of Mines.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Adhere mine safety practices as per statutes.
- CO2 - Get acquainted with mine working environment.
- CO3 - Carryout survey related to wining and working processes.
- CO4 - Perform allotted work as vocational trainee.
- CO5 - Prepare and present industrial training report based on work experience.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme														Total Marks
				Actual Contact Hrs./Week	SLH			NLH		Paper Duration	Theory				Based on LL & TL				Based on SL					
															Practical									
											CL	TL	LL	FA-TH	SA-TH	Total		FA-PR		SA-PR				
																						SLA		
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min													
333002	INDUSTRIAL TRAINING / PROJECT 2	ITR	INP	-	-	2	4	6	6	-	-	-	-	-	50	20	50#	20	100	40	200			

Total IKS Hrs for Sem. : Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
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VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Follow rigorously underground mine safety practices.	1	Underground mine safety practices: • Taking instruction from safety officer. • Recording the safety practices to be followed in mine. • Recording Don'ts and Do's/ SOP followed in various mining operations.	16	CO1
LLO 2.1 Collect the general information about mine	2	Collection of general information of underground mine like: • Name of the Mine • Name of the Owner • Name of the project officer / manager • Duration of training • Nature of training • Location of Mine Mode of entry – there number and type.	8	CO2

INDUSTRIAL TRAINING / PROJECT 2**Course Code : 333002**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 3.1 Collect information related to geology of the mine.	3	Collection of information related to geology of the underground mine: • Bore hole section, showing different strata overlying the seam • Depth of the seam from surface • Number of coal seam & their average thickness. • Dip of working seam :- flat / moderate incline / steeply incline • Strike length of seam • Nature of roof and Nature of floor • Details of presence of major fault / fold if any. • Geological Map of the Mine.	8	CO2 CO3 CO4
LLO 4.1 Collect the information and data related to drilling and Work in section as per the instructions by the concerned.	4	Collection of information related to drilling work in underground mine: • Name of drilling machine and its specification voltage rating, type of motor used, pilot circuit for operation its importance. • Type of drill machine – rotatory or percussive Type of drill rod, its length, Arrangement for fixing drill bit Type of drill bit, Diameter of drill hole in mm. Average time taken to drill one hole. • No. of holes drilled on face with size of face width x height.	24	CO2 CO3 CO4
LLO 5.1 Collect the information and data related to blasting and Work in section as per the instructions by the concerned.	5	Collection of information related to blasting in underground mine: • Name of explosive used - i) During development ii) During depillaring • Type of explosive used • Weight of cartridge • Diameter of cartridge • Length of cartridge • Charge per hole • Total explosive charged in single face / single hole • Stemming material used • Type of initiation – direct/indirect • Type of detonator used – its construction details and specification. • Study of following blasting tools. Exploder – its name, type – magneto or battery condenser capacity in terms of round it can blast at a time, operating details – direction of key Circuit tester for continuity, crimper, Scraper, Crack detector, Stemming rod • Powder factor and Detonator factor.	24	CO2 CO3 CO4

INDUSTRIAL TRAINING / PROJECT 2**Course Code : 333002**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Collect the information regarding various type of mine support and observe erection and withdrawal of supports.	6	Collection of the information regarding various type of underground mine support: • Name of support – prop / chock / cog / cross-bar / safari support / roof stitching / roof bolting / friction prop / hydraulic prop / brick walling / any other type. • Type of support – permanent / semi permanent / temporary • Method of erecting each type of support. • Load bearing capacity of support – in case of hydraulic support i) Yield load and ii) Setting load. • Additional information to be collected in case of Prop support – dimensions of lid, wedge, and base plate (if exit) • Chock / cog support – dimensions of sleepers used, pressure releasing devise (if installed) • Roof bolting – type of roof bolt, depth of hole, if mortar (mixture of sand and cement) is used sand:cement ratio. • Systematic support rules of the mine. – Copy should be obtained. • Withdrawal of supports – study the various type of safety devices used in withdrawing the support. • Good sketches of all types of supports should be brought with dimensions • Work with Timber Mistry on the faces for few days.	24	CO2 CO3 CO4

INDUSTRIAL TRAINING / PROJECT 2**Course Code : 333002**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Collect the information and data related to panel development and Work in section as per the instructions by the concerned.	7	Collection of the information related to underground mine panel development: - Type of development :- Dip / Strike / cross – cut development - Height of gallery : - Width of gallery at face : - Dimensions of pillar : - Shape of pillar : square / rectangle - Number of district / panel - Number of pillar in each panel - Type of panel : closed / open - Incubation period : - If mechanized development then in addition to above information following information is to be collected. - Name of the loading machine, Bucket capacity, Fill factor, Type / crawler mounted, Loading capacity per day - Transportation from the face chain conveyer / tubs / shuttle cars - Cycle of different operation on the faces: 1. Operation involved 2. Their Sequence 3. Time taken for each individual operation 4. Man power require for each operation 5. Production form each face / of dimension / progress per blast 6. Production of district / No of faces worked for meeting that manpower require / - O.M.S of the district & faces	24	CO2 CO3 CO4
LLO 8.1 Collect the information and data related to depillaring and Work in section as per the instructions by the concerned.	8	Collection of following information related to depillaring of underground mine panel: - Method of depillaring - Size of split - Size of stook - Line of extraction - Preparatory arrangement before depillaring - Systematic support rules (S. S. R.) - Type of depillaring: by stowing / by caving. 1. If stowing: - general stowing arrangements stowing bunker location, water : sand ratio, signaling arrangements 2. If caving: - air blast & general precautions taken to prevent air blasts.	48	CO2 CO3 CO4

INDUSTRIAL TRAINING / PROJECT 2

Course Code : 333002

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 9.1 Carryout mine ventilation survey and collect related information and data.	9	Conduction of underground mine ventilation survey: • Fan House: • Type of fan - 1. Centrifugal - backward bladed or forward bladed 2. Coaxial flow - Single stage or No. of stages • Manufacture • Diameter of fan • No. of blades • Rotations per minutes (RPM) • Water gauge developed • Motor and transmission details: 1. Specifications of motor – HP/kW, volts. R.P.M. 2. Transmission – Reduction Ratio, Type 3. Sketch of motor to fan transmission. • Water gauge 1. Construction, 2. Sketch of instrument showing how it is fitted in the fan house. 3. Reading of instrument • Fan Drift – size – width * height length inclination • Evasee chimney – sketch with dimensions – top & bottom • Air Lock doors – arrangement & to understand how the at fan house reversal of air is arranged. Sketching the arrangements for the following ventilation appliances with dimensions. • Ventilation stoppings. • Ventilation doors – In haulage roadways and in other gallery • Air crossing : • Air lock doors underground • If available regulators • If available fire stopping – its specifications, fitting preparatory stoppings in depillaring area. • Inspection of stoppings by supervisors / assistant Managers. • Intake airway and downcast shaft. • Upcast shaft and return airway • Study ventilation plan to see the distribution of air inside the mines, splits, ventilation districts. • Study of auxiliary fan arrangement if installed and precautions. • Specifications of fan, specification of tubing's, layouts. Ventilation Measurements:	48	CO2 CO3 CO4

INDUSTRIAL TRAINING / PROJECT 2**Course Code : 333002**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
		- Measurement of quantity flowing 1. Anemometer 2. Velometer - Measurement of humidity 1. Hygrometer 2. Katathermometer		

INDUSTRIAL TRAINING / PROJECT 2**Course Code : 333002**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 10.1 Collect the information and data related to mining machinery.	10	Collection of information related to underground mining machinery: Transportation: • General haulage system :- Rope haulage / belt conveyor • Number of haulages • Type of each haulages • Capacity or rating of each haulage motor • Safety appliances used on each haulage like i) Stop block, ii) Run away switch, iii) drag iv) Pull Cord.– Draw Sketches with dimension to be brought. • Signalling arrangement and code of signals • Other haulage features like i) Re-railer ii) Manholes iii) Tub arrester iv) Pullcord system in case of conveyor. v) Rollers. • Type of haulage rope – no of strands, splicing of ropes • Surface tippler – its layouts, tipping arrangements • Track, crosses, sleepers, Track fillings. Method of laying track – work with track layer for few days. Pumping Arrangement: • Type of different pumps used in the mines their i) Head, ii) H. P. – Study the Literature available in mech. Department. • Electrical switches – detail. Starting & stopping of pump. • Sketch general arrangement – starting from strainer / foot valve, suction pipe, pump, delivery pipe, delivery valve, • Arrangement for priming of the pump. • Sketch of tub with name of the parts & its capacity • Couplings, Sockets, clips etc used with haulage • No of tubs (loaded & empty) attached to different capacity haulage. Mine Shaft: • No. of shafts • Finished diameter of each shaft. • Type of lining • Shape of shaft • Headgear – General construction • Type of head gear winding • No. of cages	48	CO2 CO3 CO4

INDUSTRIAL TRAINING / PROJECT 2**Course Code : 333002**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
		• Various safety appliances like – i) Safety hook (type) ii) Automatic contrivance iii) Cage arrester, • Construction and use of keps • Guides – type, and its use		
LLO 11.1 Collect the information related to surface features.	11	Collection of the information related to <u>surface features of underground mine</u>: • Lamp room layout – cap lamp, • Explosive Magazine – precautions taken to prevent pilferage of explosive • Store room – general procedure of issuing store material • Winding engine room	16	CO2 CO3 CO4
LLO 12.1 Follow rigorously surface mine safety practices.	12	Surface mine safety practices: • Taking instruction from safety officer • Recording the safety practices to be followed in mine. • Recording Don'ts and Do's/ SOP followed in various mining operations.	24	CO1
LLO 13.1 Collect the general information about surface mine.	13	Collection of <u>general information of surface mine</u> like: • Name of the Mine • Name of the Owner • Name of the project officer / manager • Duration of training • Nature of training • Location of Mine • Mode of entry – there number and type	8	CO1
LLO 14.1 Collect the information related to geology of surface mine.	14	Collection of information related to <u>geology of surface mine</u>: • Bore hole section, showing different strata overlying the seam • Depth of the seam from surface • Number of coal seam & their average thickness. • Dip of working seam :- flat / moderate incline / steeply incline • Strike length of seam • Details of presence of major fault / fold if any • Geological Map of the Mine.	16	CO2 CO3 CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 15.1 Collect the information and data related to method of working of surface mining and Work in section as per the instructions by the concerned.	15	Mine Opening: • Site preparations • Type of entry • Mine layout • Statutory provisions & permissions w.r.t. mine opening. Method Of Working: • Type of mechanisation (manual, semi-mechanised, mechanised) • Manpower requirement • Bench geometry: Height, width, slope, ultimate pit slope, haulroad preparation. • ROM handling from mines to processing plant. • Statutory permissions and provisions w.r.t. method of working. • Monsoon preparations.	48	CO2 CO3 CO4
LLO 16.1 Collect the information and data related to drilling, blasting and Work in section as per the instructions by the concerned.	16	Drilling and Blasting in surface mining: • Blast geometry: Spacing, burden, length & diameter of drill hole, subgrade drill, stemming, explosive charge per hole, powder factor, column charge, priming charge, deck charging, etc. • Type of explosive used, its specifications, bulk explosive and cartridge explosives. • Type of initiation system of explosives, accessories used in explosives initiations, their specifications, blast initiation pattern and connections. • Blasting procedure and precautions. • Statutory permissions w.r.t. blasting. • Arrangement for storage and transportation of explosives. • Statutory permissions and provisions w.r.t. storage and transportation of explosives.	72	CO2 CO3 CO4

INDUSTRIAL TRAINING / PROJECT 2**Course Code : 333002**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 17.1 Collect the information and data related to surface mining machinery and Work in section as per the instructions by the concerned.	17	Surface Mining Machinery Construction, Working principle, Specifications and Applications of Machineries used in the respective mine: • Scraper • Dozer & Ripper • Motor grader • Roller • Drill Machines • Excavators (Rope &/or Hydraulic) • Dumpers &/or Tippers • Conveyors • Explosive van • Water tankers / sprinklers • Rock breaker • Backhoe • Other machineries.	72	CO2 CO3 CO4
LLO 18.1 Collect the information and data related to environmental impacts & measurements:	18	Environmental Impacts & measurements: • Types of environmental impacts • Measurement of ground vibrations. • Precautionary measures of ground vibration, fly rock, air blast at mines site. • Precautionary measures to reduce air-water-land pollution at mines site. • Land reclamation procedure. • EIA & EMP	48	CO2 CO3 CO4
LLO 19.1 Prepare industrial training report in standard format. LLO 19.2 Perform plagiarism check from free internet site and Submit report of plagiarism check to the allotted teacher with industrial training report.	19	Preparation of industrial training report in standard format, which includes following: • Title Page which includes: Title, Purpose of submission, Institute logo, Students Name, Industry Name, Department and Institute Name • Certificates: Student declaration, Certificate from industry • Acknowledgement • Text • Introduction to Industry • Safety Practices in Industry • Industrial Process and collected information • Working Experience • Results • Summary/Conclusion. • References	30	CO5

INDUSTRIAL TRAINING / PROJECT 2**Course Code : 333002**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 20.1 Prepare PPT for presentation of industrial training report.	20	Presentation of industrial training report.	16	CO5
Note : Out of above suggestive LLOs - • '*' Marked Practicals (LLOs) Are mandatory. • Minimum 80% of above list of lab experiment are to be performed. • Judicial mix of LLOs are to be performed to achieve desired outcomes.				

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)**Study Project**

- The students below 18 years of age and those who could not attend the training, will have to select the topic and prepare the study project based on that Topic and present it before Panel of Teachers and External Examiner.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED : NOT APPLICABLE**IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE****X. ASSESSMENT METHODOLOGIES/TOOLS****Formative assessment (Assessment for Learning)**

- Attendance during training /Selection of topic
- Collection of data / information.
- Work done and Feasibility of work/ problem identified.

Summative Assessment (Assessment of Learning)

- Report Writing and submission.

INDUSTRIAL TRAINING / PROJECT 2**Course Code : 333002**

- Presentation
- Viva voce
- End Year Examination

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1		3		3	3	3	3			
CO2	3	3	3	3	3	3	3			
CO3	3	3	3	3	3	3	3			
CO4	3	3	3	3	3	3	3			
CO5						3	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
 *PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	R. D. Singh	Principles & Practices of Modern Coal Mining	New Age International (P) Limited, Publishers, New Delhi. ISBN: 81-224-0974-1
2	Heartman L. Howard	Introductory Mining Engineering	John Wiley & Sons, New York, ISBN: 0-471 62804-2.
3	S. D. Prasad & Rakesh	Legislation in Indian Mines: A Critical Appraisal (Volume - I & II)	Vivek P-8, New Medical Enclave. B.H.U., Varanasi – 221005.

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.mining-journal.com/category/projects	Research paper publication on Mining Projects.
2	http://www.infomine.com/library/publications	Webinar publications on Mining Projects.
3	https://www.mining-technology.com/?cf-view	Publications on foreign mining practices.

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

POLLUTION CONTROL IN MINE**Course Code : 333003****Programme Name/s : Mining & Mine Surveying/ Mining Engineering****Programme Code : MS/ MZ****Year : Third****Course Title : POLLUTION CONTROL IN MINE****Course Code : 333003****I. RATIONALE**

Potential sources of environmental pollution in the mining and mineral processing industry includes drainage and sediment run-off from a site, air emissions, spills, dust, destruction of the site as well as surrounding areas, abandoned equipment, plants and buildings, and land instability and degradation. The purpose of this course is to study mine pollution and waste minimization by the mining industry. Also examines certain methods of pollution control used for air, land, water, tailings, sulphur and noise by the mining and mineral processing industries, and case study analysis in the mining industry.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop the skill to investigate pollutions in mine industry and provide sustainable solutions.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - CO1: Identify environmental pollution and implement relative laws.
- CO2 - CO2: Analyze various characteristics of air pollution in mines.
- CO3 - CO3: Develop system for treatment of water in mines.
- CO4 - CO4: Implement systems to prevent soil pollution in mines.
- CO5 - CO5: Apply various methods to control noise pollution in mines.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme													
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks		
															Practical								
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA				
							Max	Min		Max					Min	Max	Min	Max	Min				
333003	POLLUTION CONTROL IN MINE	PCM	DSE	-	-	2	-	2	2	-	-	-	-	-	25	10	25@	10	50	20	100		

POLLUTION CONTROL IN MINE**Course Code : 333003****Total IKS Hrs for Sem. : Hrs**

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
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VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 collect information on environmental pollutions and their relative laws.	1	Prepare a report on environmental pollutions and their relative laws.	2	CO1
LLO 2.1 Rigorous assess the environmental impacts for mining project	2	Preparation of Environmental Impact Assessment (EIA) for a mining project.	4	CO1
LLO 3.1 collect data and information on Green House effect, Ozone Depletion and Acid Rain.	3	Prepare a report on Green House effect, Ozone Depletion and Acid Rain.	1	CO2
LLO 4.1 Determine various pollutants in air	4	Determine the characteristics of air using air volume sampler.	2	CO2
LLO 5.1 Determine various gases pollutants in air	5	Determine various gases present in air.	2	CO2
LLO 6.1 Determine pH to know the quality of water.	6	Determine pH of water samples using digital pH meter.	2	CO3
LLO 7.1 Determine turbidity to know the quality of water.	7	Determine turbidity of water samples using digital turbidity meter.	2	CO3
LLO 8.1 Determine solids to know the quality of water.	8	Determine total solids, dissolve solids and suspended solids in given water samples.	4	CO3
LLO 9.1 Determine fluoride to know the quality of water.	9	Determine the fluoride content in given water samples.	2	CO3
LLO 10.1 Determine dissolved oxygen to know the quality of water.	10	Determine the dissolved oxygen content in given water samples.	2	CO3

POLLUTION CONTROL IN MINE**Course Code : 333003**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Select the relevant treatment method of water for given situation	11	Prepare a report on water treatment plant by field visit.	4	CO3
LLO 12.1 Select the relevant sewage treatment method for given situation.	12	Prepare a report on sewage treatment plant by field visit.	4	CO3
LLO 13.1 develop the skills to manage land reclamation.	13	Prepare a report on land reclamation methods.	2	CO4
LLO 14.1 Identify and measure vibrations in mines.	14	Study of vibration measuring instruments and measurements of vibration.	2	CO4
LLO 15.1 Study of noise measuring instruments and measurements of noise.	15	Study of noise measuring instruments and measurement of noise.	2	CO5
LLO 16.1 Collect data information on noise controlling techniques.	16	Prepare a report on noise controlling techniques.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)**Micro project**

- Prepare a report on Landscape pollution.
- Prepare a report on general standards for water and wastewater parameters.
- Prepare a report on general standards for air quality.
- Prepare a waste management plan in mine.
- prepare a report on impacts of mines on environment.
- Prepare a report on impacts of mines on public health.
- Prepare a report on acid-mine drainage.
- Prepare a report on mineral beneficiation plants.
- Prepare a report on Mine closure plan.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

POLLUTION CONTROL IN MINE**Course Code : 333003**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Digital DO meter Range: 0 to 20 ppm, Resolution: 0.1 ppm, Temperature Compensation: 0 to 50 Oe,	10
2	Vibration Measurement Instrument Display B&W 64 X 120 pixels with background light Battery Life 0 to 50 deg C	14
3	Decibel Meter Measuring range: 25 ... 136 db(A) LXY (SPL), Leq (LXeq), LXYSD, LXSEL, LXE, LXYmax, LXYmin, LXPeak, LXN Frequency weighting: A, B, C and Z Time weighting: Fast (125 ms), slow (1 sec) and impulse (35 ms), decay (1500 ms) adjustable data-recording interval from 1 s ... 24 h 1/1 octave band filter (optional 1/3 octave band filter upgrade)	15
4	Particulate Monitors Aerosol photometers operate by detecting scattered light. The amount of light reaching the detector is proportional to the number of particles passing through the detection chamber. Also known as nephelometers, these instruments are used to monitor particulate matter such as dusts, smokes, mists, and fumes. They can be used for monitoring the respirable fraction of dust, and are small enough to use for personal exposure monitoring. Results are reported in ?g/m3 or mg/m3.	4
5	Portable Gas Chromatographs (GC) Enhanced target analysis in less than 10 minutes Optimize real-time chromatogram view on PC Flexible operation in lab or field Intuitive operational design Screen, confirm, and qualify with Ellvin™ chromatography software Instrument innovation using Micro Electro-Mechanical Systems (MEMS) Detection of VOC analytes with ionization below 10.6eV	5
6	Multi-gas Monitors with PID Multi-gas monitors typically feature audible and/or visual alarms that warn of IDLH or time-weighted average toxic gas concentrations, low oxygen levels, LEL conditions, or malfunction. These monitors may operate in passive (diffusive) mode, or in active mode, in which a pump module draws air across the sensors.	5
7	Digital pH meter LED 4 digit display, 0 to 1000 mV, Resolution 0.01 pH	6
8	Digital Turbidity Meter Range 0 to 200 NTU, Resolution 1 NTU, Accuracy: $\pm 3\%$ FS, ± 1 Digit, Display 3½ Digit 7-Segment LED Light Source 6V, 0.3 Amp Tungsten Lamp, Detector: Photodiode, Sample System: 30 mm Clear Glass Test Tubes, Power 230 V $\pm 10\%$ AC, 50 Hz, Accessories Test tube Set of 5, Operation Manual, Dust Cover	7
9	Hot Air Oven Electric Oven with digital control (Temperature: 300°C. 25 kg capacity)	8
10	Evaporating Dish Standard glassware or Porcelain dish of 90 mm diameter and 100ml capacity.	8
11	Filter Papers Whatman's filter paper No. 42	8
12	Weighing Balance Electronic weighing balance of accuracy 0.01 g	8
13	Standard Fluoride testing kit	9

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE**X. ASSESSMENT METHODOLOGIES/TOOLS****Formative assessment (Assessment for Learning)**

- Attendance during practicals
- Taking Observations
- Submission of practicals

Summative Assessment (Assessment of Learning)

POLLUTION CONTROL IN MINE**Course Code : 333003**

- End semester Exam
- Performance of given practical
- Viva voce
- End semester Exam
- End semester Exam

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	0	0	0	0	3	0	1			
CO2	0	3	0	1	3	0	3			
CO3	0	2	2	2	3	0	3			
CO4	0	3	2	2	3	0	3			
CO5	0	3	2	2	3	0	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
 *PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	S.K. Tiwari	Mining And Environmental Science	Atlantic; Edition (19 February 2021) ISBN-10 ? : ? 9788126914074
2	N.C. Saxena , Gurdeep Singh & Rekha Ghosh	Environmental Management in Mining Areas	SCIENTIFIC PUBLISHERS ISBN 9788172332969
3	Dr Paul R Friesen	Environment: Mining and Pollution: Fishing vs. Mining	Lulu.com (3 January 2022) ISBN-10 ? : ? 1716042011
4	B. B. Dhar	Mining & Environment	APH Publishing, 2000 - Business & Economics ISBN 8176481483, 9788176481489

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://ibm.gov.in/writereaddata/files/09012016173455Ch3.pdf	Air Pollution
2	https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/publikationen/Chemical_Pollution/ChemPoll-LAMICS_Chapter4.pdf	Mining Industry Pollutants

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Sr.No	Link / Portal	Description
3	https://www.mahanadicoal.in/InfoBank/ENV/Important%20Legislations%20relating%20to%20Environment.pdf	IMPORTANT ACTS/ RULES/ NOTIFICATIONS/ CIRCULARS/ STANDARDS & POLLUTION CONTROL STRATEGIES RELATING TO ENVIRONMENT
4	https://forestsclearance.nic.in/DownloadPdfFile.aspx?FileName=5117124312179B5P7guidelinesforabatementofminingoperations.pdf&FilePath=../writereaddata/FormA/DetailsOfMaps/	Guidelines For Abatement of Pollution From Mining Operations
5	https://www.scribd.com/doc/10034191/Coal-Mining-Pollution-and-Its-Control-Measures	Coal Mining Pollution and Its Control Measures
6	https://ibm.gov.in/writereaddata/files/09022016092423Ch16.pdf	Environmental protection and Reclamation of land
Note : Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students		

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